THE

AMERICAN NATURALIST.

VOL. XVI. — *SEPTEMBER*, 1882. — No. 9.

METHODS OF MICROSCOPICAL RESEARCH IN THE ZOOLOGICAL STATION IN NAPLES.

BY C. O. WHITMAN.

IN the preparation of this paper Dr. Mayer has allowed me to make free use of his excellent article,[1] published about two years ago. I have added the methods of Dr. Giesbrecht, Dr. Andres and some others who have worked in the zoölogical station. Dr. Mayer has further placed at my disposal such improvements and alterations as he has been able to make since the publication of his paper. I am also deeply indebted to Dr. Mayer for advice and generous assistance, for which I wish here to give expression to my most sincere thanks and grateful appreciation.

I am still further indebted to Dr. Eisig, Dr. Lang, Dr. Andres, Dr. Giesbrecht, Professor Weismann and Professor Dohrn, all of whom I have had occasion to consult with reference to matter contained in this paper.

I. PRESERVATIVE FLUIDS.

Killing, *hardening* and *preserving* are three kinds of work, requiring for their accomplishment sometimes only a single preservative fluid, but in most cases two, three or even more. As the same fluid often does the work of killing and hardening, and sometimes of preserving too, it is impossible to divide them into three classes corresponding to the kinds of work, except by repeating many of them twice, and some of them three times. While it is therefore more convenient to include them all under "preservative fluids," as Dr. Mayer has done, it is none the less

[1] Mayer. "Mittheilungen aus der Zoologischen Station zu Neapel." Vol. II, p. 1, 1880. A summary of this paper by Geo. Brook was published in the NATURALIST, June–Oct., 1881.

important to remember what kind or kinds of work each fluid is expected to accomplish.

Kleinenberg's picro-sulphuric acid, for instance, now so much used in the Naples Aquarium, is not a hardening fluid. It serves for killing, and thus prepares for subsequent hardening.

1. *Kleinenberg's Fluid.*[1]—

Picric acid (saturated solution in distilled water) ..... 100 volumes.
Sulphuric acid (concentrated) ..... 2 "

Filter the mixture and dilute it with *three* times its bulk of water;[2] finally add as much creosote[3] as will mix.[4]

Objects are left in the fluid three, four or more hours; and are then, in order to harden and remove the acid, transferred to 70 per cent. alcohol, where they may remain 5–6 hours. They are next placed in 90 per cent. alcohol, which must be changed at intervals until the yellow tint has wholly disappeared.

Summary of Dr. Mayer's remarks on Kleinenberg's Fluid.—The advantages of this fluid are, that it kills quickly, by taking the place of the water of the tissues; that it frees the object from sea-water and the salts contained in it, and that having done its work *it may be wholly replaced by alcohol.* In this latter fact lies the superiority of the fluid over *osmic* and *chromic* solutions, all of which produce inorganic precipitates and thus leave the tissues in a condition unfavorable to staining. Picro-sulphuric acid does not, like chromic solutions, harden the object, but simply kills the cells.

As this fluid penetrates thick *chitine* with difficulty, it is necessary, in order to obtain good preparations of larger Isopoda, insects, &c., to cut open the body and fill the body-cavity with the liquid by means of a pipette. In larger objects care should be taken to loosen the internal organs so that the fluid may find easy access to all parts.

The fluid should be applied as soon as the body is opened, so that the blood may not have time to coagulate and thus bind

[1] *Quart. Journ. Mic. Sci.*, Vol. XIX, p. 208–9, 1879.

[2] Dr. Mayer uses the fluid undiluted for Arthropoda.

[3] Creosote made from beechwood tar.

[4] Dr Mayer prepares the fluid as follows:

Water (distilled) ..... 100 volumes.
Sulphuric acid ..... 2 "
Picric acid (as much as will dissolve).

Filter and dilute as above. No creosote is used.

the organs together. *A large quantity of the fluid should be used, and it must be changed as often as it becomes turbid.* The same rule holds good in the use of all preservative fluids. It is well also, especially with larger objects, to give the fluid an occasional stirring up.

In order to avoid shrinkage in removing small and tender objects from the acid to the alcohol, it is advisable to take them up by means of a pipette or spatula, so that a few drops of the acid may be transferred along with them. The objects, sinking quickly to the bottom, remain thus for a short time in the medium with which they are saturated, and are not brought so suddenly into contact with the alcohol. In a few minutes the diffusion is finished; and they may then be placed in a fresh quantity of alcohol, which must be shaken up frequently and renewed from time to time until the acid has been entirely removed.

The sulphuric acid contained in this fluid causes *connective tissue* to swell, and this fact should be borne in mind in its use with vertebrates. To avoid this difficulty Kleinenberg has recommended the addition of a few drops of creosote, made from beechwood tar, to the acid. According to Dr. Mayer's experience, however, the addition of creosote makes no perceptible difference in the action of the fluid.

This fluid must not be used with objects (*e. g.*, Echinoderms) possessing calcareous parts which it is desired to preserve, for it dissolves carbonate of lime and throws it down as crystals of gypsum in the tissues. For such objects *picro-nitric acid* may be used. It is prepared as follows:

Water.....95 parts.
Nitric acid (25 per cent. N_2O_5)..... 5 "
Picric acid as much as will dissolve.[1]

Picro-nitric acid also dissolves carbonate of lime, but it holds it in solution, and thus the formation of crystals of gypsum is avoided. In the presence of much carbonate of lime, the rapid production of carbonic acid is liable to result in mechanical injury of the tissues, hence in many cases chromic acid is preferable to picro-nitric acid.

Picro-nitric acid is, in most respects, an excellent preservative medium, and as a rule will be found to be a good alternative in those cases where picro-sulphuric acid fails to give satisfactory

[1] This mixture is used undiluted.

results. Dr. Mayer commends it very strongly, and states that with eggs containing a large amount of yolk material, like those of Palinurus, it gives better results than nitric, picric or picro-sulphuric acid. It is not so readily removed from objects as picro-sulphuric acid, and for this reason the latter acid would be used wherever it gives equally good preparations.

2. *Alcohol.*—In the preparation of animals or parts of animals for museums or histological study, it is well known that the chief difficulties are met in the process of killing. Alcohol, as *commonly* used for this purpose by collectors, has little more than its convenience to recommend it. Dr. Mayer has called attention to the following disadvantages attending its use in the case of marine animals:

(1) In thick-walled animals, particularly those provided with chitinous envelopes, alcohol causes a more or less strong maceration of the internal parts, which often ends in putrefaction.

(2) In the case of smaller Crustacea, *e. g.*, Amphipods and Isopods, it gives rise to precipitates in the body-fluids, and thus solders the organs together in such a manner as often to defy separation even by experienced hands.

(3) It fixes most of the salts of the water adhering to the surface of marine animals, and thus a crust is formed which prevents the penetration of the fluid to the interior.[1]

(4) This crust also prevents the action of staining fluids, except aqueous solutions, by which it would be dissolved.

Notwithstanding these drawbacks alcohol is still regarded at the Naples Aquarium as an excellent fluid for *killing* many animals designed for preservation in museums or for histological work. In many cases the unsatisfactory results obtained are to be attributed not to the alcohol *per se*, but to the *method* of using it. Most of the foregoing objections do not, as Dr. Mayer has expressly stated, apply to fresh-water animals; and Dr. Eisig informs me that he has no better method of killing marine annelids than with alcohol. Judging from the preparations which were kindly shown to me, and which were all beautifully stained with

[1] Dr. Mayer first noticed this in objects stained with Kleinenberg's hæmatoxylin, and afterwards in the use of cochineal, where a gray-green precipitate is sometimes produced which renders the preparation worthless. Such results may be avoided by first soaking the objects a few hours in *acid alcohol* (1–10 parts hydrochloric acid to 100 parts 70 per cent. alcohol).

borax-carmine, Dr. Eisig's mode of treatment must be pronounced very successful. The process is extremely simple; a few drops of alcohol are put into a vessel which contains the annelid in its native element, the sea-water; this is repeated at short intervals until death ensues. After the animal has been thus slowly killed, it may be passed through the different grades of alcohol in the ordinary way, or through other preservative fluids. Objects killed in this manner show no trace of the external crust of precipitates which arises where stronger grades of alcohol are first used. The action of the alcohol is thus moderated, and the animal, dying slowly, remains extended and in such a supple condition that it can easily be placed in any desired position. The violent shock given to animals when thrown alive into alcohol of 40 per cent. to 60 per cent., giving rise to wrinkles, folds and distortions of every kind, is thus avoided, together with its bad effects.

3. *Acid Alcohol.*—In order to avoid the bad effects of alcohol, such as precipitates, maceration, &c., Dr. Mayer recommends *acid alcohol*—

95 volumes 70 per cent. or 90 per cent. alcohol.
3 " hydrochloric acid.[1]

for larger objects, particularly if they are designed for preservation in museums. The fluid should be frequently shaken up, and the object only allowed to remain until thoroughly saturated, then transferred to pure 70 per cent. or 90 per cent. alcohol, which should be changed a few times in order to remove all traces of the acid. For small and tender objects, acid alcohol, although preferable to pure alcohol, gives less satisfactory results than picro-sulphuric acid.

4. *Boiling Alcohol.*—In some cases among the Arthropods, Dr. Mayer has found it difficult to kill *immediately* by any of the ordinary means, and for such cases recommends *boiling absolute alcohol*, which kills instantly. For Tracheata this is often the only means by which the dermal tissues can be well preserved, as cold alcohol penetrates too slowly.

5. *Osmic Acid.*—Dr. Mayer employs osmic acid as a staining medium for the hairs, bristles, &c., of the dermal skeleton of Arthropods. The luster of Sapphirina is preserved by this acid,[2]

[1] Acid alcohol as above prepared loses its original qualities after standing some time, as ether compounds are gradually formed at the expense of the acid.

[2] See corrosive sublimate, p. 705.

and according to Emery, the color of the red and the yellow fatty pigments of fishes.

Van Beneden found osmic acid the best preservative fluid for the Dicyemidæ, and my experience leads to the same conclusion.[1]

Although Dr. Mayer seldom uses this medium where histological details are required, he observes that in those classes of animals whose bodies are easily penetrated with watery fluids, osmic acid is seldom to be dispensed with.

Bleaching.—It often happens that objects treated with osmic acid continue to blacken, after removal from the acid, until they are entirely worthless, and such results are even more annoying than the difficulties in the way of staining. It has been said that the blackening process can be arrested by certain staining media, but it is certain that picro-carmine will not always do this, as some of my preparations of Dicyemidæ show. It is therefore a very important step which Dr. Mayer has taken in finding a method of restoring such objects. The method[2] is as follows: *The objects are placed in 70 per cent. or 90 per cent. alcohol, and crystals of potassic chlorate ($KClO_3$) shaken into the liquid until the bottom of the vessel is covered; then a few drops of concentrated hydrochloric acid*[3] *are added with a pipette, and as soon as chlorine (easily recognized by its greenish-yellow color) begins to be liberated, the whole gently shaken. As soon as the bleaching is finished the objects are removed to pure alcohol.* By this method Dr. Mayer has been able in half a day to restore large Pelagia, Carinaria, Rhizostoma, &c. Small objects generally require a shorter time and less acid. The process can be greatly accelerated by heating on a water-bath.

Using Sapphirina as a test-object, Dr. Mayer found that the luster which characterizes the living animal entirely disappeared by the bleaching process. As this luster, which has its seat in the epidermis, depends on the interference of light, it is evident that the cells had undergone *some* change, but a change so slight that the tissues could hardly be said to have been injured for his-

[1] One of the best objects for testing methods is found in *Phronima sedentaria*. Here the cells and nuclei are so sharply defined that they can be seen in the living animal, and so the effect of a preservative fluid can be easily studied.

[2] A slightly modified form of the method originally given in Müll. Arch., 1874, p. 321.

[3] Nitric acid may be used instead of HCl.

tological purposes; besides, the removal of the osmic acid leaves the animal in a good condition for staining.

Dr. Mayer's experience with Sapphirina appears to support him in the following conclusions in regard to the nature of the action of osmic acid, viz., that the hardening effect of the acid is due to the formation of inorganic precipitates within the tissues. This is made evident by the fact that the animal becomes soft and flexible as soon as these precipitates are removed by bleaching.

This method of bleaching has been used by Dr. Mayer for removing natural pigment. Alcoholic preparations of the eye of Mysis, for instance, can be fully bleached in toto, but with better success by operating with single sections. To avoid swelling, which is apt to arise by the use of aqueous fluids, staining media of an alcoholic nature should be used.

6. *Chromic Acid.*—Chromic solutions have in common with osmic acid, the peculiarity of hardening by virtue of the chemical combinations which they form with cell-substances, and all the consequent disadvantages with respect to staining. The use of chromic acid in the Zoölogical Station of Naples may be said to have been largely superceded by *picro-sulphuric acid*, *corrosive sublimate* and *Merkel's fluid*, for it is now seldom used except in combination with other fluids.[1] It is sometimes mixed with Kleinenberg's fluid, for example, when a higher degree of hardening is required than can be obtained by the use of the latter fluid alone. It is a common error to use too strong solutions of chromic acid, and to allow them to act too long. Good results are in some cases obtained when the objects are treated with a weak solution (⅓–½ per cent.) and removed soon after they are completely dead.

7. *Merkel's Fluid.*—

Platinum chloride dissolved in water	1:400
Chromic acid " "	1:400

Professor Merkel,[2] who employed a mixture of these two solutions in equal parts for the *retina*, states that he allowed from

[1] Dr. Pfitzner ("Morph. Jahrb.," B. XVII, p. 731, 1882) has recently made use of chromic acid followed by (1) *osmic acid*, or by (2) *chloride of gold*, *formic acid* and *safranin* (or hæmatoxylin) for the demonstration of nerve-terminations.

Flemming (see his method on a following page) believes that chromic acid is one of the most reliable fixing reagents for the karyakinetic figures, and has proved that objects hardened in this acid can be beautifully and durably stained.

[2] "Ueber die *Macula lutea* des Menschen," &c., Leipzig, 1870, p. 19.

three to four days for the action of the fluid. Dr. Eisig has used this fluid with great success in preparing the delicate lateral organs of the Capitellidæ for sections, and recommends it strongly for other annelids. Dr. Eisig allows objects to remain 3–5 hours in the fluid, then transfers to 70 per cent. alcohol. With small leeches I have found one hour quite sufficient, and transfer to 50 per cent. alcohol.

8. *Corrosive Sublimate.*—Prompted by a statement found in an old paper by Blanchard,[1] Dr. Lang began experimenting with corrosive sublimate as a medium for killing marine Planarians, and his marked success led him and others to employ the same with other animals. In most cases Dr. Lang now uses a *saturated solution of corrosive sublimate in water.* A saturated solution in picro-sulphuric acid, which in some cases gives better results if a little acetic acid (5 per cent. or less) is added, is also used.[2] Blanchard's mode of treatment was to mix a quantity of the aqueous solution with the sea water, and thus poison the animals. Dr. Lang, on the contrary, removes the sea water so far as possible before applying the solution. With Planarians he proceeds in the following manner:

The animal is laid on its back and the water removed with a pipette, the solution being then poured over it, it dies quickly and remains fully extended. After half an hour it is washed by placing it in water and changing the water several times during thirty minutes. It is next passed through 50 per cent., 70 per cent., 90 per cent. and 100 per cent. alcohol. In two days it is fully hardened, and should then be stained and imbedded in paraffin as early as possible, as it is liable to become brittle if left long in alcohol. The time required by the corrosive sublimate varies with different objects, according to size and the character of the tissues. As a general rule, it may be said that objects should be removed from the fluid as soon as they have become thoroughly

[1] "Recherches sur l'Organisation des Vers," by Emile Blanchard. Ann. des Sci. Nat. Zool. Ser. 3, t. VIII, 1847, p. 247.

[2] These solutions given in *Zoolog. Anzeiger*, 1879, II, p. 46.

The original solution (*Zoolog. Anzeiger*, 1878, I, p. 14–15), now little used, stood thus:

Distilled water	100 parts.
Common salt	6–10 "
Acetic acid	5–8 "
Corrosive sublimate	3–12 "
Alum (in some cases)	½ "

saturated by it. In order to kill more quickly than can sometimes be done at the ordinary temperature, the solution is heated, and in very difficult cases may be used boiling.

Corrosive sublimate has been used with success by Dr. Lang and others in the following cases: Hydroids, corals, Nemertines, Gephyrea, Balanoglossus, Echinoderms, Sagitta, Annelids, Rhabdocœla, Dendrocœla, Cestodes, Trematodes, embryos and adult tissues of Vertebrates and, according to Mayer and Giesbrecht, Crustacea with thin chitinous envelopes, *e. g.*, Sapphirina, Copepods and larvæ of Decapods.

The two great advantages of Dr. Lang's method are, (1) that animals so treated are easily stained, and (2) they are killed so quickly that they are left, in most cases, in a fully extended condition. Hot corrosive sublimate kills leeches so instantaneously that they often remain in the attitude assumed the moment before the fluid is poured over them. The color, however, is not so well preserved as when killed with alcohol, or even with weak chromic acid.

It should be remembered that objects lying in a solution of corrosive sublimate must not be touched with iron or steel instruments; wood, glass or platinum may be used.

9. *Dr. Andres' Methods of treating Actiniæ.*—Among the various methods employed by Dr. Andres in killing the Actiniæ, the three following, given in the order of their excellence, are said to have worked most satisfactorily:

A. Corrosive sublimate.—With small animals a hot solution, used in the manner recommended by Dr. Lang, gives good results; with larger animals, where this mode of treatment fails, the fluid must be injected. The cannula of a glass syringe, filled with the hot fluid, is inserted into the mouth at the moment it opens, which act habitually follows on gently touching the lip. After injecting, the hot solution is poured into the glass containing the animal and a small quantity of sea water.[1]

If the operation is cleverly performed, the animal remains fully expanded, as the mechanical pressure of the injected fluid prevents contraction.

After from five to fifteen minutes the animal is washed in distilled water and allowed to remain twelve hours in 50 per cent.

[1] *Andres.* "Intorno all'Edwardsia Claparedii," in the Proceedings of the "Reale Accademia dei Lincei," Vol. v, Ser. 3, Mar. 7, 1880, p. 9.

alcohol,[1] then passed through the higher grades of alcohol. Borax-carmine and hæmatoxylin used for staining.

B. Glycerine and Alcohol.[2]—

Glycerine	20 parts.
Alcohol (70 per cent.)	40 "
Sea water	40 "

This mixture, poured very slowly into the containing glass, often gives very good results, both for anatomical and histological purposes.

C. Nicotine and Tobacco Smoke.— *a.* A solution of nicotine (1 g.) in sea water (1 l.), conducted into the vessel containing the animal fully expanded in a half liter of sea water, by means of a thread sufficiently large to empty the flask holding the nicotine solution in the course of twelve hours.

b. The vessel containing the animal in an extended condition, covered by a bell jar in which tobacco smoke is confined, until the animal becomes completely benumbed.

After being deprived of sensibility by either of these methods, the creature may be killed in corrosive sublimate, or in picro-sulphuric acid.

D. Dr. Andres finds that in the use of chloroform, dropped slowly into the water, or administered in form of vapor, maceration usually sets in before the power of contracting is lost. Good preparations of the internal parts may be obtained by injecting a weak solution of osmic acid. The method of freezing has also been employed with some success. For this purpose three vessels are placed one within the other, the central one containing the actinia, the middle one ice and salt, and the outer one cotton.

The ice containing the congealed animal is dissolved in alcohol or an acid.

E. Maceration.—It is often important to see the cells of a tissue *in situ* before freeing them with needles. In such cases Dr. Andres proceeds as follows:

1. Killed with corrosive sublimate.
2. Left in 25 per cent. alcohol twenty-four hours.
3. Soaked for a short time in a very thin solution of *gum arabic*, then in a somewhat thicker solution, and finally imbedded in a very thick solution.
4. Hardened in 90 per cent. alcohol.
5. Thick sections prepared for dissection with needles. The sections are placed on a slide in water, which dissolves the gum.

(To be continued.)

[1] A little camphor (1 ccm. to 100 ccm.) added to the alcohol will facilitate the removal of the sublimate.

[2] This method originated with Salvatore Lobianco.

NOTES ON THE HABITS OF THE "SAVANNAH CRICKET FROG."

BY CHARLES C. ABBOTT.

ONE of the earliest indications of returning spring is the clear, bell-like note of the little batrachian, called by many the "Savannah cricket," known in New Jersey as the "peeper," and scientifically designated *Acris crepitans* Baird.

Abundant as is this batrachian, but little seems to be known of its habits, and certain misstatements concerning them have been long in print, and have never, that I am aware, been either questioned or contradicted.

During the month of April, 1881, I had excellent opportunities for observing these little creatures, and finding that but little had been recorded concerning them, availed myself of my chance, and watched them closely for several weeks.

While a network of ditches in a low meadow were being repaired and cleaned, I followed the workmen closely, for the purpose of gathering any novelties that might be thrown out with the mud and dead leaves that had accumulated in the ditch-bottoms. Much of interest was found, particularly a number of the rare "Muhlenberg" turtles; but the one striking feature of the locality, at this time, was the wonderful abundance of little "rattlers" (*Acris crepitans*), as I prefer to call them. They were in full song, and when not disturbed, made more noise than all the frogs in the neighborhood together. They were quite timid, however, and on being approached were straightway "mum." Their vocal efforts seemed to increase until about May 1st, when their eggs were deposited in little masses, attached to the blades of coarse grass. I did not succeed in following the various stages of developmental growth from the egg to the matured animal, but was enabled to determine that it was more protracted than in the case of the common tree-toad (*Hyla versicolor*). The difference is, I believe, quite seven weeks.

To return to the adult "peepers." From the date of their earliest appearance until May 20, their numbers were incalculable. In every portion of the meadows at all wet, they were to be seen. Extremely active and very shy, they were difficult to catch, provided you pursued a single individual, but by sweeping an ordinary dip net along the grass at the edge of any little pool, sev-

eral were certain to be caught. They fed ravenously at this time, and even when confined in very cramped quarters, would devour any flies that came within reach. On the other hand, they were the main food-supply of certain fishes, all the snakes, the turtles, and a few species of birds.

I found that all our snakes at this time (April and May) were more abundant in the meadows than elsewhere, and have no doubt were drawn thither for the purpose of feeding on these little batrachians. Even that lover of high, dry and dusty fields, the hog-nosed snake (*Heterodon phatyrhinus*) was found to be stationed at intervals along the ditch banks, on the lookout for "peepers;" the dissection of one of these snakes proved that it had fed upon these small frogs.

About the 20th of May there was a very noticeable diminution of their numbers, and by the 10th of June not a specimen was to be found.

The fact is, that their vigor culminates with the maturity of the ova and spermatozoa, and having spawned, they have no vital force remaining, and in the course of a few days after ovipositing, they die. Weeks then elapse when no representatives of this batrachian are to be found; indeed none exist, except the thousands of tadpoles. Late in August these tadpoles had become fully developed "peepers." Even then they were very rare during that summer (I suppose this is always the case), but in September many were found in damp places, never in the water, but always near a running brook, or a spring. By the middle of September a marked increase in their numbers was noticed; but their haunts were different. I found very few in the meadows, but many in damp places, as spring holes, in the adjacent woodland, and particularly along a brook where the water flows rapidly over a rocky bed.

It was here that I closed my field studies of these batrachians. Early in October I found a number of these "peepers" in a little ravine through which the above-mentioned brook passes. I noticed at this time, that these little creatures had a decided aversion to the water. Necessary as it was for them to keep their skins moist, they had no desire to become thoroughly wetted, and when by chance they made an unlucky jump and settled in the water, they straightway crawled out and took up a high and dry position on some projecting stone. If in the sun-light so

much the better. A bath seemed to chill them, and whenever I drove one into the water, I found that for several minutes after it emerged I could pick it up without difficulty; but in time it would regain its ordinary activity, and then quick indeed must be one's movements who would catch them with the hand alone.

It was at this time, too, that I gave close attention to the subject of their color and its changeableness.

While there are certain peculiarities of color that are persistent and characteristic of the species, these become of little prominence at times, so very great is the difference in the entire coloration of the animal. Furthermore, they change their hues with great rapidity, and during the course of a few moments will pass from an ashy paleness or clay color, to an intense black, with the light dorsal stripe scarcely visible, or else either a glowing red or brilliant metallic green. So very beautiful are these changes, and so different will any half dozen prove to be, that it is difficult to realize that the many before you are one and the same species. Of a series of six which I have long kept in confinement (October 20th to January 29th) in a bottle, one specimen was taken from a ledge of pale yellow clay. The "peeper" was of the same color, the post-orbital dark spot and light dorsal line being scarcely discernible. The uniform yellow tint, however, was relieved by minute round points of brilliant bronze. This individual, unlike its companions, did not alter in color for several weeks. The others were very changeable, and particularly so when exposed to direct sun-light. While I noted several instances to the contrary, my impression is that usually the colors pale in direct sun-light, and deepen when the animals are in deep shade. This certainly is true of those I have in confinement, and agrees with my experience in searching for them during the past autumn. One fact with reference to the subject of their color is not in accordance, perhaps, with the above, but should not go unrecorded. The six individuals which I have in a bottle will, at times, present very different tints, although all are subjected to like surroundings. Of the six, two or three would be very dark, the others pale yellow. With some the dark triangular spot between the eyes would be very distinct, in the case of the others it could not be detected, even in outline. It must be remembered, however, that these individuals were kept in most

unnatural conditions, and had, at the time of this writing, been without food for one hundred days, and at the same time remained as active as squirrels.

Sensitive as these "peepers" are to changes of temperature, it is by no means the first frost that drives them into their winter quarters. In the autumn of the past year (1881) I found them last as late as Nov. 12th, but even later (Dec. 27th) my son found one in the meadows which was as lively as a cricket. The frogs generally were singing this day. For more than two weeks prior to Nov. 12th there had been several white frosts, and the true frogs (Ranæ) had all disappeared except such few as lingered in the warm waters of the larger springs. Not so, however, with the "peepers;" the cozy, sheltered nooks in the ravine I have mentioned, afforded them comfortable quarters still, and after a severe rainstorm which lasted for three days, I found numerous specimens near the brook, always in moist places but not where it would be called wet. In many instances they were found adhering to the under sides of projecting stones, roots of trees, and even to large oak leaves. I find it stated by De Kay in Natural History of New York, that they cannot retain their hold upon the under sides of projecting objects; that the discs on their toes are not sufficiently large. This is an error; indeed, the specimens I have in a bottle, can retain their hold when the bottle is turned over.

My impression is, that they do not require or partake of any food during their brief experience as matured "peepers" in autumn (*i. e.*, from completion of the growth of their limbs in September to the commencement of their hibernation). My reason for this is based upon the fact that the specimens in a bottle, to which I have referred, were placed in confinement on the 20th of October, 1881, and the date of writing, Jan. 29, 1882, a period of one hundred days has just elapsed. During this time these "peepers" have had no food, have been quite as active as their limited quarters would permit, and yet have not lost weight to any important extent. One which I weighed on the day following its capture weighed forty-four grains, and seventy-five days later had lost but one grain in weight.

It is very different in the spring; then they are voracious feeders, and capture millions of minute insects. At this time their stomachs are always full; and while the size of the animal is not

larger than in autumn, the weight is nearly twice as great. Their physiological activity culminates with the maturing of the ova and the labor of depositing it; this effected, they are worn out and in a very short time, die.

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THE EVOLUTION OF FORMS FROM THE CLINTON TO THE NIAGARA GROUP.

BY EUGENE N. S. RINGUEBERG.

WHILE collecting Niagara and Clinton fossils in the village of Gasport during the fall of 1881, I was struck by the peculiarity of texture and character of the fossils contained in the upper band of limestone; which is there found superimposed upon the series forming the upper portion of the Clinton group proper, and I at once recognized a similarity between its fauna and structure, to an analogous layer which I had previously noticed in the western portion of the town of Lockport, but had failed to find at several other points of outcrop.

At the place where it was first noticed, however, its character, both in regard to the fossils contained, which there are generally rare and fragmentary, and the general appearance of the rock, is not so pronounced in distinction from the underlying strata as at Gasport.

This layer is not continuous, but apparently occurs in confined areas. Thus it is found at Gasport and again in the western portion of the town of Lockport. But in the city, about two miles east from the latter point, and on the same line of outcrop, whose general direction is from east to west, it is entirely wanting, as I have ascertained by a careful examination of both natural and artificial exposures at the line of juncture between the Niagara shale and Clinton limestone.

It is extremely variable in thickness, but I should judge its greatest development to be in the neighborhood of two feet. This is merely to be taken as an estimate, as I have not been able thus far to take the proper means of obtaining accurate measurements.

The upper surface is extremely irregular and undulating; having the appearance of being drifted together. This is also corroborated by the position of many of the fossils, which seem to have been swept together by eddies, which at the same time were

charged with sedimentary matter by which they were entombed as we now find them.

Thus immense numbers of the cephalic and caudal shields of *Illænus barriensis* will be found in the space of perhaps ten or fifteen inches, and outside of this accumulation there will not be any except a stray one or so.

In one vertical section of the stone in my collection, two inches in diameter, the fracture shows thirteen shields of this trilobite crowded one above the other. It also does not seem to have any very regular lines of stratification. At Gasport the limestone has a light bluish tint, and breaks, when comparatively free from fossils, with a clean flinty fracture, and is very hard, fine grained and compact. The majority of the shells have the interior filled with crystallized calcite, and some of the larger cephalopods are lined with crystals of the same. From all information obtainable, it seems that this layer has always been associated with the Clinton group. Its fossils, however, prove that it is more closely allied to the Niagara.

The most common forms are *Atrypa nodostriata* and *Meristina nitida*, both of which are Niagara forms. After these we may cite *Spirifera radiata*, *Lichenalia concentrica* and *Illænus barriensis;* which are common to both. The first of these reaches its perfection in the Clinton, and is found in a minor degree in the subsequent shales of the Niagara, while the two last are but sparingly found in the Clinton, and are found in the greatest numbers at the opening of the Niagara series.

But the most striking feature of this limestone—for which I propose the name of the *Niagara Transition Group*—is the abundance and perfection of the Cephalopoda, which in all other strata of the Niagara period in Western New York are quite rare, with the exception of *Orthoceras annulatum*, which is found in moderate numbers in the Niagara shale and also is the most common of the Clinton forms. In this respect as in the identity of a number of species, we find a strong analogy to the limestones representing the Niagara group in the Western States. In it we find *Cyrtoceras hercules*, *C. brevicorne*, *Trochoceras costatum*, *Trochonema pauper*, *Palæocardia cordiformis*, etc., which will be recognized as western species.

The majority of the species, as will be seen by the following

lists, are Niagara; next in number come those common to both, after which will be found the Clinton and characteristic species:

NIAGARA SPECIES.

Calymene niagarensis,
Bronteus niagarensis,
Orthoceras medullare,
" *alienum,*
Cyrtoceras cancellatum,
" *hercules,*
" *brevicorne,*
Trochoceras costatum,
Trochonema pauper,
Palæocardia cordiformis,
Cypricardinia undulostriata,
Callopora elegantula,
" *laminata,*
Trematopora ostiolata,
Fenestella cribrosa,
Pentamerus interplicata,
Stephanocrinus gemmiformis,
Atrypa nodostriata,
" *rugosa.*
Cœlospira disparilis,
Rhynchonella cuneata,
" *obtusiplicata,*
Spirifera eudora,
" *niagarensis,*
Meristina nitida,
" *oblata,*
" *maria,*
Orthis flabellum,
" *hybrida,*
" *biloba,*
Streptorhynchus subplana,
Strophodonta striata.

SPECIES COMMON TO THE NIAGARA AND CLINTON.

Illænus barriensis,
Orthoceras annulatum,
Modiolopsis subalatus,
Avicula emacerata,
Lichenalia concentrica,
Caryocrinus ornatus,
Spirifera radiata,
Strophomena rhomboidalis,
Meristina intermedia,
Atrypa reticularis,
Rhynchonella neglecta.

CLINTON SPECIES.

Murchisonia subalata,
Athyris congesta,
Orthis lynx.

CHARACTERISTIC SPECIES OF THE NIAGARA TRANSITION GROUP.

Discina solitaria (n. sp.), *Leptæna sericea* var. *intermedia* (n. var.).

As will be seen there are three species which have been considered to pass out of existence with the Clinton, that still survive in the stratum under consideration; unless we should also include the Leptæna described below.

Meristina intermedia has been placed in the list of species common to both groups, as the one from the Transition stratum, as well as those from the Clinton, are indistinguishable from specimens found in the Niagara shale; the only perceptible difference being a gradual falling off in size as we advance upwards in the series, and a slight diminution of the average width, so that some from the Niagara approach closely to the typical *M. nitida*, although others will be found that are fully as wide as those from the Clinton.

In all probability *M. nitida* and *M. oblata* are descendants of

M. intermedia; one branch developing in width while the other became narrow and elongate.

Thus far no Meristinæ have been found with a pronounced mesial fold, of which *M. naviformis* of the Clinton, and *M. maria* of the Niagara may be considered as types, although an intermediate form will, I think, be found.

The three specimens of *Stephanocrinus gemmiformis* found, all show a marked angularity of form similar to some young *S. angulatus.*

A Leptæna occurs in this rock that seems to be intermediate between *L. sericea* and *L. transversalis*, which it resembles in the convexity of the dorsal and the concavity of the ventral valves, while in texture, which is punctate and not so strongly striate as in *L. transversalis*, and by its wide lateral alation, it is more closely allied to *L. sericea.* Therefore I propose the name *Leptæna sericea* var. *intermedia*, as it undoubtedly represents the stage through which *L. sericea* passed before developing into what is known as *L. transversalis.*

The *Atrypa nodostriata* found here does not have so prominent a mesial fold as the Niagara forms, it being more gradual, and but little more pronounced than is found to be the case in gibbous specimens of *A. reticularis* from the Clinton.

Other species show slight variations from the Niagara types, or perhaps, more properly speaking, the types vary from the transition species.

Thus it will be seen that in many ways this apparently unimportant thin stratum, with its limited areas, that has been overlooked by the hundreds of geologists that have traversed this far-famed geological field, who probably have been lured from greater palæontological wealth by the tempting display of finely weathered-out fossils on the shale banks immediately above, as well as discouraged by the difficulty of wrenching the treasures from its flint-like grasp, plays a very important factor in the connecting chain of palæontological evolution. It binds together in closer unity two formations by its intermediate character, and also by the blending in it of forms before considered characteristic of these two well-defined groups.

Discina solitaria (n. sp.).—Shell oval, ventral valve with prominent apex; slope convex, slightly incurved near the apex on the posterior side; strongly marked by recurved concentric laminæ, of which, near the apex, there are about eight to one-eighth of an inch; these grow more crowded, wider and less recurved as they ap-

proach the margin, where they project from the surface on a plane with the valve and lie one against the other; these lower laminæ, when magnified, present a deeply wrinkled and furrowed appearance; these furrows are irregular, and proceed from the shell, growing fainter at the margin of the laminæ, and are scarcely perceptible unless the laminæ above are broken, apex about two-fifths of the length from the anterior edge; length, seven-eighths inches, width, six-eighths inches; height of apex

Discina solitaria (n. sp.)—*a*, ventral valve, nat. size; *b*, ventral valve, lateral view, nat. size; *c*, ventral valve, anterior view, nat. size; *d*, undulate surface of lamina from near the edge, enlarged; *e*, recurved laminæ from near the aperture, enlarged.

one-fourth inch. Foramen commences at the apex and extends half way down the side; shell barely incurved at this point, laminæ continuing without interruption to the edge of the apex here.

NOTE.—Since the above was written I have succeeded in procuring a young specimen of a Meristina with a mesial fold. It appears to be closely allied to *M. maria*, and it has consequently been placed in the Niagara list until other specimens are found which will determine its relationship more clearly.

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HYPNOTISM IN ANIMALS.[1]

BY D. W. PRENTISS.

Mesmerism, or more properly *hypnotism*, has been recognized under various names in the history of all nations.

The same influences which work the modern phenomena of hypnotism are undoubtedly identified with the manifestations of magic found described in ancient history. The magic of Zoroaster, the wonderful performances of the magi of the East—among the ancient Persians, Hindoos and Egyptians—the spells and incantations of the Grecian and Roman oracles, the methods of divination, the remarkable feats of the snake charmers of India and Egypt, all belong to the same category.

And so also might we include the more recent wonderful manifestations of religious mania which swept Europe in the seventeenth century as an epidemic, known as the "dancing mania," and was literally a national calamity. In our own country it was

[1] Read before the Biological Society of Washington, D. C., March 31, 1882.

represented at the close of last century by the witchcraft of New England, and still later within the memory of men now living, by the "convulsive" and "laughing" mania among the Methodists—notably in the State of Kentucky, where it is said that on one occasion as many as 5000 persons in camp meeting were under the "influence" at one time. The victims fell in convulsions and soon passed into a state of ecstatic trance, and were laid out on the grass in rows to recover themselves.

Physicians are brought in contact continually with similar conditions as forms of disease, under the names of hysteria, catalepsy, ecstacy and lethargy. No more marvelous stories can be found in the whole range of fiction than are presented as sober matters of fact in the standard works on nervous diseases—such as of Charcot, Weir Mitchell and Hammond.

In this place are to be classed the modern miracles of the Church. The history of "Our Lady of Lourdes" finds an exact parallel in many of the cases that have been lately so thoroughly studied at the Hospice Salpetriére in France, by Chalcot.

All of these phenomena may be grouped into a single allied genus, of which the various forms of manifestation may be considered species. *Mesmerism* is one of the species, clairvoyance and modern spiritualism may be mentioned as others. No systematic or scientific attempt was made to study into the nature of these phenomena until the time of Mesmer, from whom this term is derived.

Mesmer was a German physician who went to Paris in 1778 to practice his new discovery of "animal magnetism" in the cure of disease. In six years he amassed a large fortune, and during that time kept Paris in a fever of excitement with his doings.

In 1784 a royal commission was appointed, of which Benjamin Franklin was one, to investigate his methods. Their report was unfavorable to the claims of animal magnetism, and Mesmer's popularity soon declined.

Mesmer's exploits in Paris are designated by Mills as the first epoch in "mesmerism."

The second epoch is that of Braid, an English physician, 1841. Braid disclaimed anything like animal magnetism in his operations, and explained them by referring to physiological and psychological influences in the subject.

He gave the name of *hypnotism* to the phenomena produced,

and like Mesmer applied his skill to the treatment of diseases; the diseases claimed to be influenced favorably being neuralgia, hysteria, epilepsy and the like. Surgical operations were also performed painlessly during the anæsthesia of the hypnotic state. Teeth pulling, excision of mamma, and even amputations of the thigh, are among the operations performed. Braid published a voluminous book upon the subject, relating his views and experiences.

The third epoch of Mills we are now passing through. The experiments and writings of Heidenhain of Germany, of Charcot and Richer of France, and of Beard, Hammond and Mills in this country, have revived the interest in the subject, and hypnotism is again being subjected to a rigid scrutiny.

The subject is one of great interest in itself, not only from a scientific standpoint, but also from the fact that more precise knowledge of the laws governing the phenomena presented may be of practical value. That hypnotism has been used with apparent benefit in the treatment of certain diseases, appears in the experience of many writers upon the subject, and it is certain that the anæsthesia thus induced may be taken advantage of for the performance of surgical operations. Recently in an exhibition by Dr. Hammond before a medical society in N. Y., a tooth was extracted without pain, and a subject was burned with a red hot iron without conscious sensation. If the application of hypnotism could be reduced to a science, it is among the possibilities of the future that it might supercede the use of such agents as chloroform and ether as anæsthetics.

In the present state of knowledge, however, this is impracticable, as well also as its use as a therapeutic agent. Although the subject has engaged the attention of investigators for centuries, no acceptable explanation of the manifestations of mesmerism has yet been offered.

Undoubtedly a large proportion of the acts shown in public exhibition are due to trickery and collusion, but I think no one can witness such an exhibition as was recently given in Washington, by Carpenter, without feeling that *all* is not deceit, that there is an influence at work which thus far has not been fathomed.

Mesmer called it animal magnetism, and claimed it to be an emanation from his person, as electricity from a battery.

Braid rejected the animal magnetism theory, and referred the phenomena to psychical influences (*neurypnology*).

The latest attempt at a theory is that of Heidenhain, just promulgated: "Hypnotism is due to inhibition of the cortical cells of the cerebrum, caused by gentle, prolonged stimulus of the nerves of the face, eyes or ears."

This definition of Heidenhain's is, to my mind, but little more satisfactory than any preceding one. It merely attempts to describe by an hypothesis a physical effect, leaving out of sight the ultimate cause. I have given more time than I had intended to the general subject of hypnotism, and have perhaps only stated facts known already to the members of this society. I have done so, however, in explanation of my reason for bringing before your notice the subject of hypnotism in animals.

1. The general subject is one of more than passing interest to men of science.

2. It is one the true inwardness of which is but little understood, and which presents a field for further investigation.

3. The study of the phenomena presented by experiments upon animals, and of observations on their habits, offers a promise of more definite results than can be obtained from observations upon man alone.

It is necessary to state that I have no pet theory of my own to propound or uphold, but it is my hope in reviewing and briefly analyzing the history of hypnotism in the lower animals, to develop facts known to naturalists that may have an important bearing upon the subject. The practice of magic on the lower animals has a somewhat parallel history in ancient nations to that already referred to in connection with man. All nations and tribes have their conjurors, more or less expert. Probably the most expert are the "serpent charmers" of India and Egypt. Of these mention is made in the most ancient writings as well as in modern books of travel. The serpent is the favorite animal on which to exhibit the influence of these charms—for what reason may possibly be explained by modern herpetologists. In Dr. Spry's "Modern India," published in 1837, is a description of the method of operating of one of these Indian magicians. He says: "An eminent physician, skeptical on this point (serpents and birds being drawn and held as by a charm), in company with other English gentlemen thus tested the fact. Taking a serpent

charmer alone, they brought him to a distant heap of rubbish, and causing him to lay off all his raiment that there might be no deception practiced upon them, they watched his movements.

"Approaching the pile with a serpent-like hiss and nervous working of the features and limbs, which became more and more excited and violent, presently serpent after serpent of the most venomous kind, showed their heads and gradually moved towards their charmer, until reaching out his hand he took them as so many lifeless withes, and deposited them in his basket." Numberless attested incidents of a similar kind might be given, the operator winding the serpent about his neck and pressing coil after coil into his mouth, and rendering it rigid as a stick or pliant as a cord at pleasure.

In a report on the "Manners and Customs of the modern Egyptians," by E. W. Lane, 1836, is an almost identical account of snake charmers of Egypt, and their method of drawing serpents out from the houses.

In 1646 Athanasius Kercher, an Italian monk, described what he termed the "Experimentum mirabile." It was an experiment which has since become sufficiently familiar to all of us, but which appeared to the old monk little less than miraculous.

He tied the feet of a hen together and laid her on the ground, where after cries and violent struggling she became quiet, "as if," says he, "despairing of escape through the fruitlessness of her motions, she gave herself up to the will of her conqueror."

Kircher then drew a chalk line in a diagonal direction from one eye to the other, loosened the ribbon, and the hen, although left perfectly free, remained immovable, even when he attempted to rouse it. Kircher believed that the hen thought the chalk line was a string by which it was bound as at the feet, and attributed its quiet state to this idea.

The most extended observations upon hypnotism in animals have been made by Czermak in the private physiological laboratory of the University of Leipsic. The results obtained were reported in two lectures delivered by him in January, 1873, and published (in translation) in *Popular Science Monthly* for Sept. and Nov., 1873.

Czermak dwells upon the unreliability of untrained observation in such matters, and says that the usual reports, while honest and technically true from the observer's standpoint, are in their conclusions generally false.

To such inaccurate reports he applies the term "events viewed unequally." From this view the "experimentum mirabile" of Kircher is characterized as inaccurate, it is an "event viewed unequally." Czermak repeated the experiment, tying the legs of the fowl, pressing it down upon its side and making the chalk mark in front of its bill. It laid quiet, panting just as Kircher has described. The chalk line was then dispensed with, and still the animal remained quiet; and finally the tying of the feet was left out, and still the same result. It was not therefore the imagination of the hen, produced by the chalk line, as Kircher supposed, that rendered the animal lethargic, but some other cause not yet explained.

A friend of Czermak's told him a story about mesmerizing crawfish; that by making certain passes in the direction of the body, the animal became stiff and soon stood on its head, and after a while by reverse passes it resumed its natural position and crawled off. Czermak was skeptical, but a capture from the neighboring brook dissipated his doubts. Just what has been described took place. Not only this but Czermak himself found he also possessed the same magic power over the Crustacean. He was not satisfied to stop here. Pursuing his experiments, he found that passes were not needed either to put the crawfish on end or to bring him down again. He obtained a basketful of the animals, turned them out on the table, stirred them up a little, and lo! all of them turned tail up and stood so for a short time, when they gradually descended and crawled away. It was further observed that the crawfish would remain motionless in any position in which forcibly held until struggling ceased. Czermak repeated his experiments with ducks, geese and swans with similar results; but whether he is justified in claiming, as he does, with the positiveness of *italics*, "that he has proved the appearance of hypnotism in animals," I think is open to doubt, and it may be, in the light of the naturalists' knowledge, that even he has not viewed his "events equally." Czermak makes another statement with which I very much doubt whether those who have studied the habits of animals, will agree.

He says: "With animals every one feels safe from all thoughts of deception." Evidently he had never surprised a 'possum in a midnight raid upon a hen-roost; or if he had witnessed that interesting animal "playing possum," he may have considered it a

very aggravated case of "hypnotism in animals," for certainly the hen and crawfish are entirely eclipsed by the wily marsupial.

No naturalist will say that we are "free from all thoughts of deception with animals," for I am sure each person present can call to mind many instances of deliberate deception, not only on the part of animals in the restricted sense, but cases of insects simulating death appear to be very common.

Indeed it seems to be an instinct of self-preservation with insects, worms and many others of the lower orders of life, in case of danger to draw up into as small a space as possible and remain perfectly quiet until the danger is passed.

In the year 1859, while enthusiastically interested in ornithology, I shot a turkey buzzard (*Cathartes aura*). The bird was winged, and when approached was standing up under a laurel bush, looking brightly about, one wing hanging. As I came up he first disgorged, then as I continued to approach, his head began to droop to one side, and by the time I reached him he lay upon his side apparently lifeless. Believing that he really was dead, I with difficulty forced him into my game bag and proceeded home, a distance of two miles. He was then taken from the game bag and thrown down in the yard, limp and lifeless.

My surprise can be imagined when calling out the family to view the capture a moment later, he was found running around the yard as lively as ever. On our approach, however, the same motions were enacted, and again he lay upon his side dead. This routine followed each approach, until after a while he became accustomed to the presence of persons, and then would simply hiss and disgorge. (In the "Birds of the Northwest," 1874, p. 383, Dr. Elliott Coues recounts a similar incident.)

Mr. Nelson informs me that he has witnessed a like action on the part of the wild goose when wounded. As soon as it finds escape impossible, it will stretch out its neck and remain stiff and immovable, so that it may be handled in this condition, the muscles remaining rigid as in catalepsy. If, however, it is not disturbed, it will soon begin to peep around and gradually attempt to get away.

In the case of the opossum, the simulation of death is so perfect that only the closest examination can determine that life still is present—in the pulsation of the heart and in the almost suppressed respiration. In this condition either the animal has lost

the sensation of pain, or else it possesses most wonderful powers of endurance, for it permits itself to be actually vivisected without showing the least sign of consciousness. If, however, attention is withdrawn, the sly rascal opens his eyes, glances around, and, if the coast is clear, gently departs.

I have stated that the various explanations offered of the phenomena of hypnotism, seem unsatisfactory. I have no doubt that you have now the same impression in regard to this paper, that it is unsatisfactory in offering nothing definite in the way of classifying the phenomena under discussion. I have indicated my belief that in the phenomena of the so-called mesmerism, there is *something*, some influence or influences at work not yet understood, and like *life* itself, possibly may never be. We may be obliged to content ourselves with calling this subtle substance by a name, be it mesmerism, hypnotism, or what not, and resting there. The direction, however, in which progress can undoubtedly be made with positive advantage, is in classifying the phenomena presented. In this direction does a knowledge of the peculiarities of animals, learned by both experiment and observation, become valuable. The factors entering into the production of the phenomena noticed in the experiments of Czermak and others, are: Fear, dissembling, curiosity, training, and changes in the condition of the blood.

1. *Fear.*—In the case of the hen and canary, an overwhelming irresistible force is used, reducing the poor creatures to a feeling of utter helplessness in the hands of a giant-man.

They lie in any position in which they are placed, because they fear to move. A chalk line or bright button attract their attention and excite fear because they know not but they might explode like dynamite if a move be made. Through the influence of profound fear also, a state of semi-unconsciousness may be induced, just as we hear of persons being *paralyzed* by fear.

We can realize to a small degree what this state of helplessness may mean to a small animal, by imagining the feelings of a traveler stopped by highwaymen with a loaded carbine at either temple. When he is ordered "*hands up*," up his hands go, and so are likely to remain until the coercion is removed.

Another homely example. Prisoners of war are enclosed in a stockade, sentinels with loaded muskets pace the platform around the top; a line is drawn around the inside space a certain dis-

tance from the fence called the *dead line.* It is but a step to cross it, but I need not say that step is not taken. This line is as forbidding to the prisoner as is the chalk line to the hen.

2. *Dissembling.*—Trickery and collusion on the part of the human subject which enters as such an important element into human exhibitions, I dismiss with the mere mention. There is not time to discuss it within the limits of this paper.

Dissembling in animals I have perhaps already referred to sufficiently in taking exception to Czermak's statement that "with animals every one feels safe from all thoughts of deception." I therefore simply refer again to our old friends the opossum, the turkey buzzard and the goose.

Under this head also would be classed the "playing dead" of insects, worms, &c., and the familiar example of the skill shown by birds in pretending to be wounded, fluttering helplessly along the ground, to draw an intruder away from the nest.

3. *Curiosity.*—I believe that curiosity plays a part in the power exercised by the snake charmers of India. The operator goes to a stone pile, and his noises and motions excite curiosity on the part of the serpents. So also is it probable that music has charms.

Another probable element is, that the Indian magician has studied the calls of the serpents, and by his imitation draws them forth. We know how easy it is in this way, by imitating their notes, to call birds. The success of the shooter of "shore birds" depends very much upon his expertness in imitating the whistle of the different species. The phenomena of handling serpents, rendering them stiff or flaccid at pleasure, I do not pretend to understand, but hope an explanation will be developed in the course of the discussion.

Examples of curiosity displayed by animals are numerous and well known. The hunter on the plains decoys deer by simply lying down and kicking up his heels. Ducks are *toled* on the shores of the Chesapeake by waving a red flag, or by having a little dog trained to run up and down the bank barking. The ducks swim in to see what the strange object is, until they are brought within range of the gun.

Mr. Henry Elliott, in his monograph on the fur seal (Census of the Fisheries, 1882) tells how the crafty foxes of the Pribylov islands capture sea birds by working on their curiosity. He

says: "One of the curious sights of my notice in this connection was the sly, artful and insidious advances of reynard at Tolstoi Mees, St. George, where conspicuous and elegant in its fluffy white dress, it cunningly stretches on its back as though dead, making no sign of life whatever, save to gently hoist its thick brush now and then; whereupon many dull and curious sea birds (*Graculus bicristatus*) in their intense desire to know all about it flew in narrowing circles overhead, lower and lower, closer and closer, until one of them came within sure reach of a sudden spring and a pair of quick snapping jaws."

Who shall say after this exhibition of craftiness that animals are free from deceit, or that birds are less consumed by the fire of curiosity than their allies, the featherless bipeds.

4. *Training.*—Where experiments are made upon the same animal repeatedly, we may suppose that it becomes, in a measure, *trained.*

It comes to learn what is expected of it, and in the case of the more intelligent animals, as the dog, there is added a desire to please its master.

At the meeting of the Intern. Medical Congress held in London, Aug., 1881, Professor Goltz, of Strassburg, exhibited a dog with certain portions of the cerebrum removed, and from the effects upon the animal, argued against the theory of Professor Ferrier as to certain localizations in the brain. In the course of the discussion, however, it was developed that the actions of the dog were in a great measure due to an unconscious training on the part of his master, Professor Goltz, who had so often exhibited the animal that he had come to know what was expected of him.

5. *Changes in the condition of the blood.*—Another element of influence also in the experiments upon fowls, is the interference with the respiration produced by the forcible compression of the chest walls. In this way proper aeration of the blood does not take place, and the accumulation of venous blood in the nerve centers produces a sort of lethargy.

Ornithologists, when collecting, are in the habit of killing wounded birds by compressing the thorax, this method not injuring the plumage; and they are familiar with the condition first of violent struggles, then of lethargy and finally of insensibility, before death is complete. Frequently when the bird is apparently lifeless, life returns when the compression is too soon removed.

A condition of anæsthesia in man may also be produced by an almost opposite state of affairs. It is known to physicians that rapid forcible inspiration of air will induce anæsthesia, and slight surgical operations have been thus painlessly performed.

We have referred now to the influence of fear, dissembling, curiosity and training. These have their influence over both man and the lower animals alike. But there are still other conditions and qualities of the mind which exert their influence over man alone—such as the power of the imagination, the disposition of imitation, and the influence of the will of the operator.

In regard to the imagination I think it is unnecessary to do more than refer to it. Its power is proverbial, and is especially realized by physicians both in the manner it impresses disease and treatment. We see continually diseases which are produced by imagination and which are as well cured through the same agency.

Witness many miraculous cures. In the case of Mrs. Jennie Smith, R. R. evangelist; she was sixteen years in bed paralyzed, but cured in one night by power of prayer. In hysterical paralyses there is added a suspension of *will power*. If this can be restored, cure is assured. The cure may be sudden, the result of a powerful impression made upon the dormant faculties, or of an intense appeal to the imagination. In this case it is considered by the laity as miraculous. Or the cure may be gradual, under the persevering effort of a good physician. In this latter case no superhuman agency is supposed to have been evoked. This may appear foreign to our subject, but is really germane, as illustrating an important element in hypnotism.

Imitation.—The power of imitation is as well known as that of imagination. Who has not been present in church when, during the stillness of an impressive sermon, some one begins a hacking, irritative cough. Soon it is taken up by one after another, until several will be coughing at once, while many others will, with difficulty repress the desire. So with gaping or yawning.

The hysterical epidemics already referred to, such as the dancing mania, the laughing and convulsive attacks at religious revivals, etc., are evidences of the power of imitation.

So also, undoubtedly, the professional mesmerist owes much of his success in public exhibitions to the same influence. The force of example impels many persons, almost against their will,

to take part in the foolish show, while others with difficulty resist the same impulse.

Lastly, as an element in hypnotism, is the *will* of the operator. Undoubtedly the best operators are persons of strong will and great persistence. The influence of a strong will is felt constantly in the daily walks of life, in all our intercourse with our fellows. In the mesmerism of men, those whose minds are naturally weak, or who have become enfeebled by disease, are the ones most easily controlled. This has long been known, but recently very satisfactorily exemplified by Charcot and his associates in France at the Hospice Salpetriére (an institute for the treatment of nervous diseases). In the Biological Society of Washington, there is material for many good masters of mesmerism, but I doubt if a single good subject can be found.

I have now reviewed and classified all the elements entering into the production of hypnotism, as fully as the time will allow.

That a very large proportion of the phenomena exhibited, may be referred to one or other of these divisions, I think is evident from the requisites which Heidenhain lays down as necessary to the development of hypnotism in man.

1. Undivided attention. Concentration of the attention by an upward gaze at a bright object placed near the eyes.

2. Willingness and desire on the part of the subject. Persons cannot be mesmerized against their knowledge and consent.

3. Use of touches, passes, etc. (to stimulate the imagination).

4. Direct command from the operator to sleep.

In regard to the second of these—" willingness and desire on the part of the subject "—much doubt has been expressed, and professional mesmerists are not willing to admit that consent is necessary. The question is of special interest in consequence of its medico-legal bearing, and the statement of Heidenhain is in accordance with the views of experts who have given the subject study. Many cases might be cited to prove the opposite, but an analysis of them show that they " are events viewed unequally."

Persons who have been frequently mesmerized acquire such a frame of mind from habit and intuitive training that they may be thrown into this condition merely by the power of the imagination. Thus a mesmerist so influenced a lady, while in the adjoining room, she being told that he was putting her to sleep. On another occasion she was told that he was mesmerizing her from

the next room, and she immediately went to sleep, although the pretended operator was not in the house and knew nothing about it. In a "good subject" it may be sufficient to impress upon their minds the idea that the event is about to take place, in order to secure its occurrence.

I have said that there was still *something* about hypnotism which had not yet been fathomed. By that I do not wish to be understood as saying that there is anything mysterious or supernatural in it. But simply that we do not yet understand sufficient of the intimate workings of mind, or of the relation between mind and matter to follow the connection between various mental attributes. We are accustomed to consider these attributes as seen in the ordinary or normal state, but are not prepared to say what would be the effect of abolishing or suspending certain functions, upon other functions of the mind.

In a well marked case of hypnotism in man, freed from all elements of deceit, the condition of the mind of the subject shows an alteration of normal functions and a perversion of the will power, so that he is completely under the guidance and control of the operator.

Sensation is also so perverted that it too appears to be at the mercy of the operator. Heidenhain expresses it in more exact language by saying that there is "inhibition of the cortical cells of the cerebrum."

(At the close of the reading of the paper, a hen and canary bird were introduced and successfully "mesmerized" by Dr. Prentiss.)

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RECENT LITERATURE.

OUSTALET'S MONOGRAPH OF THE MEGAPODIIDÆ.[1]—In this monograph, as in most monographs of vertebrate groups, the interrelation of whose species is known, the number of distinct forms has been reduced. As this reduction has been made after a thorough study of the examples in the British Museum, London Zoological Society and Leyden Museum, as well as those in the Muséum d'Histoire Naturelle at Paris, there is little doubt that the conclusions arrived at will be generally accepted.

This peculiar family of birds is remarkable for its practice of artificial incubation as well as for the strength and weight of its

[1] *Monographie des Megapodiidés.* Par M. E. OUSTALET. Annales des Sciences Naturelles. VIe ser. T. x., No. 4, p. 60. VIe ser. T. XI, No. 1, p. 48. VIe ser. T. XI No. 2. p. 134, pl. 2.

bones. According to Parker the entire skeleton of the great hornbill, *Buceros ruficollis*, is not three times the weight of the leg bone of a Talegalla. The real relations of these birds have long ago been proved to be with the Gallinaceæ or Rasores, and more recent researches have proved their close affinity to the Cracidæ. The classification adopted by M. Oustalet is, in the main, that of Huxley, that is to say, the Alectoromorphæ or typical Rasores include the groups Cracidæ, Megapodiidæ, Numididæ, Meleagridæ, Phasianidæ and Tetraonidæ in the order named.

The first part of the monograph is devoted to the consideration of the skeleton, muscles and digestive, respiratory and tegumentary systems; followed by a statement of the relations of the group with those around it.

Then follows a full description of each species, with measurements, habitat, and whatever is known of habits, food, etc. The genus Megacephalon includes one species only, *M. maleo*, the largest of the entire group, a native of the northern coast of Celebes and of the Island Siao, one of the Sanghir group. This fine bird lays in August and September, at which season it leaves the forest in pairs and proceeds to the sea-shore, where in coarse sand, above the level of the tides, it digs a hole four to five feet wide and one to two feet deep. In this the female lays a single egg, but the natives affirm that thirteen days afterwards the same pair return and a second egg is deposited. As many as seven or eight eggs may be contained in one hole, but it by no means follows that they are the product of the same pair. The top of the head of the male is adorned with a black casque about three centimeters in height.

The genus Leipoa contains also only a single species, *L. ocellata* (Gould), a native of the south-west of Australia, where it resides in the brushy prairies. It is of the size of a small turkey, but shorter in the legs. The natives say that it is so timid that in its haste to escape it often becomes entangled in the brush, and is thus easily caught. As a rule it lives on the ground, drinks seldom, feeds upon seeds and orthopterous and hemipterous insects, and sleeps upon the trees. Its nest is a mound forty or more feet in circumference and sometimes five feet high, built by the labors of both sexes out of the ferruginous gravel that forms the soil of the openings in the prairies, with a bed of leaves at its base in which the eggs are deposited. The egg is $3\frac{6}{10}$ inches long, and it is probable that several days intervene between the deposition of the successive eggs. However this may be, the native pheasant contrives to retard the development of the eggs first laid, for the young usually appear at the same time, break unassisted through the walls of their prison, and find ample food in the ants and ant larvæ that swarm within the mound.

The genus Telegalla contains seven species inhabiting Austra-

lia, New Guinea and some of the neighboring islands. The mounds built by these birds are entirely composed of vegetable matters collected industriously from the surface of the ground. That of *T. lathami* measures as much as six to seven feet in height and twelve to fourteen in diameter, but this pile is not the work of a single pair, and sometimes seems to contain the eggs of two females in the same season. The heat in the central portions of these mounds reaches 37° to 39° Centigrade. This Talegalla inhabits the whole of the eastern part of Australia, its eggs are highly prized both by aborigines and colonists, and the bird itself is easily tamed and of excellent flavor.

The remaining species of the genus inhabit New Guinea and the surrounding isles.

The most widely spread and largest genus of the family is that from which its name is derived. Nineteen species of Megapodius, distributed over a large part of Oceanica and in some of the Indian isles, are distinguished by our author. Most of these have somber, uniform plumage, and all live in brush or forest, generally near the sea, feed upon fruits, seeds, insects and worms, deposit their eggs in mounds of sand, earth and vegetable matter, and do not care for their young, which are robust and completely feathered when hatched. All run swiftly, but fly heavily. *M. dilkwyni* inhabits the Philippine islands; *M. nicobariensis*, the islands from which it is named (it is the *Omaah*, *Meka* and *Dale* of the natives); *M. la perousii*, the Marianne islands; *M. senex*, the Pelew islands; *M. stairi*, Ninafou or Good Hope island near the Tonga archipelago; and *M. layardi*, the New Hebrides. Thus the geographical distribution of the group is much wider than has been hitherto believed.

The mounds of *M. duperreyi*, the best known species, a native of New Guinea and Queensland, sometimes reach a height of fourteen feet and a circumference of a hundred and forty feet, but such mounds are the work of generations of birds, and are only found in places where they have worked undisturbed by egg-hunting aborigines or colonists. A height of five or six feet is usual.

DONNELLY'S ATLANTIS.[1]—The author's purpose in preparing this book, is to demonstrate some thirteen propositions, several of which he claims to be novel; and here we think the author is correct. Some of them are as follows:

1. That there once existed in the Atlantic ocean, opposite the mouth of the Mediterranean sea, a large island, which was the remnant of an Atlantic continent, and known to the ancient world as Atlantis.

2. That the description of this island, given by Plato, is not, as has been long supposed, fable, but veritable history.

[1] *Atlantis: the Antediluvian World.* By IGNATIUS DONNELLY. Illustrated. New York, Harper & Brothers. 1882. 12mo, pp. 490.

3. That Atlantis was the region where man first rose from a state of barbarism to civilization.

4. That it became, in the course of ages, a populous and mighty nation, from whose overflowings the shores of the Gulf of Mexico, the Mississippi river, the Amazon, the Pacific coast of South America, the Mediterranean, the west coast of Europe and Africa, the Baltic, the Black sea and the Caspian, were populated by civilized nations.

Our author having, as he appears to believe, established these points, is fully convinced that not only was this Atlantis the true antediluvian world, the Garden of Eden, the Elysian fields, &c., &c., but that the gods and godesses of the ancient Greeks, the Phœnicians, the Hindoos and the Scandinavians were simply the kings, queens and heroes of Atlantis, and the acts attributed to them in mythology are a confused recollection of real historical events. His thirteenth and last proposition is that when Atlantis sunk under the waves "a few persons escaped in ships and in rafts, and carried to the nations east and west the tidings of the appalling catastrophe, which has survived to our own time in the flood and deluge legends of the different nations of the old and new worlds."

The book is the result of extensive but desultory reading, neither critical nor well directed. We may admire the author's courage, while we may not have so high an opinion of his judgment in dealing with subjects in regard to some of which the ablest investigators might well hesitate to express an opinion. So-called demonstrations based on improbable hypotheses, in this book go hand in hand with a leveling democratic use or misuse of authors, which is characteristic of works of the character of the "Atlantis." He does not seem to recognize the fact that one writer may carry more weight than another.

The author starts with the view that the results of the *Challenger's* researches were to establish the existence of a submarine Atlantean continent; whereas if any one geological fact seems to have been elicited by the soundings made in the North Atlantic, and one about which the soundest geologists are agreed, is the view that the ocean beds have always been such. If this be so, the foundations of a hypothetical Atlantis have been removed; and so one might go through the book and show, in the light of modern anthropology and philology, that the positions soberly advocated by our well-meaning author, are simply absurdities. The book is well written, with excellent illustrations, and type and press work are most creditable to the publishers, but the time for such books has gone by, since the results of recent geological and anthropological as well as philological studies combine to show that man originated somewhere in Central Asia, and migrated westward. If the reader thinks that our criticisms are unjust, let him, after reading the "Atlantis," examine Tylor's

Anthropology and Dawkin's Early Man in Britain, and the late Mr. L. H. Morgan's writings on the North American Indians.

UNDERWOOD'S FERNS.[1]—Last year the first edition of this book was noticed in the NATURALIST. It is with great pleasure that we welcome the new and much enlarged edition which has just come to hand. It has been carefully revised and much new matter has been added. As now published it includes the whole of the Pteridophyta, that is, the so-called vascular cryptogams. Many new paragraphs and a chapter or two are added to the text, and considerable changes and additions have been made in the systematic portion. On pp. 34 and 35 the asexual and sexual generations are respectively called the *Pteridoid* and the *Thalloid* phases, two most excellent expressions, which ought to be introduced into usage in the books. On p. 53, in giving the names of the seven divisions or sub-kingdoms of the vegetable kingdom, the author, for the sake of uniformity, writes *Zygospora*, *Oospora*, *Carpospora*, instead of Zygosporeæ, Oosporeæ, Carposporeæ, which is an attempt in the right direction. The literature of the Pteridophyta is greatly extended, and appears to be pretty full. It is certainly a very valuable part of the book, as it includes, in the case of American works, not only the books, but many papers in periodicals, reports, etc.

The arrangement of the orders of Pteridophytes followed, is as follows:

Class I.—EQUISETINÆ. Orders Calamariaceæ and Equisetaceæ.
" II.—FILICINÆ. Orders Ophioglossaceæ, Marattiaceæ and Filices.
" III.—RHIZOCARPEÆ. Orders Marsiliaceæ and Salviniaceæ.
" IV.—LYCOPODINÆ. Orders Lycopodiaceæ, Lepidodendraceæ, Sigillariaceæ, Selaginellaceæ and Isoetaceæ.

The important announcement is made, at the end of the volume, that the author has under preparation a Synopsis of the Hepaticæ on a plan similar to the work under review. We hope that its appearance will not be long delayed, and trust that it will prove to be as valuable a hand-book as has "Our Native Ferns." —*C. E. B.*

STUDIES FROM THE BIOLOGICAL LABORATORY OF JOHNS HOPKINS UNIVERSITY.—The second number of the second volume of this valuable series is fully equal in interest to those which have preceded it. While it contains some medico-biological and physiological papers, the purely zoölogical ones are the following: List of Medusæ found at Beaufort, N. C., during the summers of 1880 and 1881, and a paper on the development of the ova in Salpa, by W. K. Brooks; On the origin of the so-called "test cells" in the ascidian ovum, by J. McMarrich; Some notes on the development of *Arbacia punctulata*, by H. Garman and B. P.

[1] *Our Native Ferns and their Allies, with synoptical descriptions of the American Pteridophyta north of Mexico.* A second and enlarged edition of Our Native Ferns and How to Study Them. By LUCIEN M. UNDERWOOD, Ph.D., professor of geology and botany in the Illinois Wesleyan University. Bloomington, Ill., 1882.

Colton; On the structure and significance of some aberrant forms of lamellibranchiate gills, by K. Mitsukuri (reprinted from *Quart. Journ. Micr. Sc.*); Observations on the early developmental stages of some polychætous Annelides, by E. B. Wilson.

RECENT BOOKS AND PAMPHLETS.—Bulletin of the United States National Museum, pp. 360–415, 1882. From the department.

Proceedings of the Academy of Natural Sciences of Philadelphia, pp. 105–184, 1882. From the society.

Proceedings of the Boston Society of Natural History, Vol. XXI, Part III, October, 1881–January, 1882. From the society.

Revista Cientifica Mexicana, 1882. From the publishers.

Bulletin de la Société Zoologique de France pour l'année 1881. The same for 1882. From the society.

Mission Scientifique au Mexique et dans L'Amérique Centrale. Recherches Zoologiques. Troisième partie Études sur les Reptiles et sur les Batraciens. Par MM. Dumeril et Bocourt. Paris, 1882. 4 plates.

Paleontographica. Beiträge zur Naturgeschichte der Vorzeit. Die Saurier der unteren Dyas von Sachsen. Von Dr. H. B. Geinitz und Dr. J. V. Deichmüller. pp. 46, pl. IX. Cassel, 1882. From the authors.

Ein Beitrag zur Kenntniss fossiler Ueberreste aus der Gattung Arctomys. Von Dr. R. F. Hensel. Mit 2 Tafeln. From Dr. Torrey.

Bidrag till Kännedomen af Crustaceernas Anatomi. Af I. A. Lyttkens. pl. II.

Prodromus faunæ Copepodorum parasitantium Scandinaviæ. Quem scripsit Dr. Petrus Olsson.

Quarterly Journal of the Geological Society. Vol. XXXVIII, Part II. London, 1882.

Proceedings of the Royal Geographical Society, July, 1882.

Studies from the Biological Laboratory, Johns Hopkins University, Baltimore, Vol. II, No. 3, June, 1882.

Proceedings of the American Philosophical Society, January to June, 1882. From the society.

On the Origin of Jointed Structure. By G. K. Gilbert. From the author.

Fragments of the coarser anatomy of the diurnal Lepidoptera. By S. H. Scudder, 1882. Reprinted from Psyche. From the author.

U. S. Geographical Surveys west of the 100th Meridian. Capt. G. M. Wheeler in charge. Vol. III. Supplement, Geology. Report upon Geological Examinations in Southern Colorado and Northern New Mexico, 1878–1879. By J. J. Stevenson, Ph.D. In four parts and an appendix. pp. 458, pl. 4, maps. 3, 49 text cuts. Washington, 1881. From Capt. G. M. Wheeler.

Description of some Iguanodon remains indicating a new species, *I. seelyi*. By J. W. Hulke, Esq., Pres. G. S. Ext. from Quart. Jour. Geol. Soc., May, 1882. From the author.

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GENERAL NOTES.

BOTANY.[1]

NOTES ON MISTLETOES.—In a meeting of the Academy of Natural Sciences of Philadelphia, in October, 1881, Thomas Meehan, in commenting on specimens of *Phoradendron juniperum* var. *libocedri* Engelm. and *Arceuthobium occidentale* var. *abietinum* Engelm., from Nevada, noted a few facts in relation to mistletoes, which are of such interest that we transcribe them verbatim. Mr. Meehan said:

"The mistletoe of the Eastern States had a general resemblance to that of Europe, *Viscum album;* but the old genus Vis-

[1] Edited by PROF. C. E. BESSEY, Ames, Iowa.

cum had been divided by modern botanists, although the lines of distinction were somewhat artificial. We had two genera, Phoradendron and Arceuthobium. Among the leading distinctions might be mentioned that the European branch of the family Viscum, as now restricted, had the anther open by three pores or slits, our Phoradendron by two, while the Arceuthobium had but one. There were other slight differences in pollen grains, cotyledons and form of the fruits. The European mistletoe is usually found on deciduous trees only, an instance being recorded where it had been found on the Scotch pine in Germany, and its American representative, *Phoradendron flavescens* Nuttall, seemed also confined to deciduous trees and shrubs.[1] This extends across the continent, a form being found on the Pacific coast, still confined to deciduous plants; while another genus, Arceuthobium, seems wholly confined to the coniferous trees which are mixed with the deciduous ones. The name Arceuthobium is suggestive of this fact, it being derived from two Greek words signifying "living on the juniper," Phoradendron, on the other hand, meaning simply "living on, or stealing from trees." Arceuthobium, however, did not live wholly on junipers. In the herbarium of the academy was a specimen of *A. occidentale* growing on *Juniperus occidentalis* —these Nevada specimens were on *Pinus ponderosa*. The specimens of *Phoradendron juniperinum* were growing on *Libocedrus decurrens*, which, by the way, was, he believed, the first time this pretty cupressineous tree had been reported from the State of Nevada. Among the differences noted by Engelmann in the Botany of California between Phoradendron and Arceuthobium, was that while the former flowered in February and March, and matured its fruit 'next winter,' the fruit of the Californian species opened in the summer, and did not mature 'till the second autumn.' The European mistletoe was stated by Bentham to open in spring, and perhaps this was so; it was formerly supposed to be the case with the American *Phoradendron flavescens*, but Mr. Wm. Canby had shown to the academy recently, that in Delaware the flowers opened in the fall, and the fruit matured in the autumn of the following year, or just one year afterward. The flowers and fruit were on the trees at the same time together. If this were general with Phoradendron, it still lessened the distinctions between the genera. Usually Phoradendron bore leaves, while Arceuthobium was leafless—but the Libocedrus parasite was as destitute of leaves as an Arceuthobium, and the common observer would see little in their general aspects to distinguish them. But there was one great difference in the genus, at least as represented by these two species. In opening the box which contained the specimens, the whole mass was covered with a dense viscid secretion, which rendered it very difficult to separate one branch from another. On leaving the lid open a little while,

[1] Mr. Jos. James believes he saw a specimen some years ago on *Abies Canadensis*.

the watery particles soon evaporated, leaving a dry gummy deposit over the whole surface. While this was going on, the seeds were ejected with great force from their endocarps, being projected against the face with such force as to leave a stinging sensation. Dr. Engelmann has noted this power of ejection in the berries of this plant. The Phoradendron exhibited no trace of any such power, though there seemed to be little difference in the structure of the berries. The facts raised a nice teleological question. Birds did not seem to use the berries. As they were so viscid that the famous bird-lime is made from some species, it is probable the very viscidity would prevent the free use of the beak in any attempt to use the seeds. But it was believed that by becoming attached to the feet or feathers of birds, the seeds were widely distributed, and that in this way the plant had all the advantage necessary for distribution in the 'struggle for life.' But Arceuthobium, besides all the advantages to be derived from this mode of distribution, had an additional aid from a projecting force.

"Did Arceuthobium at one time exist when or where there were no birds, and had it to depend on projection alone for its distributing power, and is the viscidity a later development? Did Phoradendron once possess the power, and has it abandoned it from having through the ages found out that it travels well enough without its exercise? Or is it rather, as the speaker himself inclined to believe, that nature loved to aim expressly at variety, and was continually exhibiting her power to accomplish the same end by a wonderful variety of means? But whatever might be thought of the various theories of development, and the laws of final causes which may have operated to produce changes, there could be but little doubt but parasitism was an acquired habit, and the endeavor to find out what these plants were, and how they behaved before they were parasites, was fast becoming one of the most interesting of biological studies.

"The seeds ejected from the endocarp in Arceuthobium fastened themselves to the branches of trees by a glutinous mass at one end. This end was opposite to the radicle, which, in germinating, would have to push out from above, and curve downwards towards the branch in order to attach itself. He had not seen them during the process of germination, but as the testaceous covering was held fast by the glutinous secretion, it is probable the cotyledons would be drawn out as the plumule took its upright position, leaving the testa as an empty case fastened to the branch. Presuming that this must be the case with other Loranthaceous plants, it was difficult to understand the process by which the East Indian species performed the locomotive feat recently noted by Dr. Watt, and which from its remarkable nature has had a wide publication. It was reported as the observation of Dr. Watt that a seed falling on and becoming attached to the coriaceous leaf

of a Memecylon, would send out its radicle, which, curving down, formed a flattened disk by which it attached itself to the leaf. But, as if it knew that a leaf could not permanently support a perennial plant, the cotyledons were lifted and turned to the other side, when the end with the disk moved to another place, and in this way, the seed traveled to a more favorable spot. Without reflecting on the observation, Mr. Meehan believed it should be repeated in order to be sure of no mistake. In all plants in our country which fastened to an object through a disk at the end of a rootlet or tendril, as in Ampelopsis and *Bignonia capreolata*, the attachment was made while the disk was forming. A disk once formed, did not reattach itself to an object when removed from the original spot. In like manner the cotyledons, once removed from the endocarps, would have no viscidity with which to form a resisting power while the disk was unfastening itself from its undesirable location. There was, however, so much of singular behavior in the mistletoe family that further observations were very desirable."—*Proc. Acad. Nat. Sci. Phila.*

Differences in Radial Thickness in Tree Trunks.—Dr. Stearns in a recent paper read before the Am. Forestry Association, calls attention to certain differences in the diameters of tree trunks which are well worthy of more extended observation. He asks "whether the greatest diameter is persistently incidental to a certain aspect or quarter of the compass." Professor Whitney found the greatest diameter of the giant trees of California, (*Sequoia gigantea*) to be twenty four feet, one and one half inches; this was in a north and south direction. The least diameter was twenty three feet, in an east and west direction.

Furthermore, a remarkable difference was observed in the lengths of the several radii. The radial length from the heart of the tree to the circumference at its south point was thirteen feet, nine and one half inches (13 ft. 9½ in.), while the corresponding measurement north of the heart was but ten feet, four inches (10 ft. 4 in.). The radii making up the east and west diameter were of equal length, that is, eleven feet, six inches (11 ft. 6 in.).

Dr. Stearns suggests that the excess of growth of the south half of the trunk may be due to the greater heat and light which it received. The climate of the site of the tree under consideration, the Calaveras grove, is cool, hence the greater heat of the side exposed to the sun was advantageous to it. "In a comparatively arid region, with a high temperature and infrequent rainfall and a dry atmosphere, we may suppose that the southerly half of a tree might, through excess of light and heat, suffer from dessicating influences, and make a less growth than the northerly half, as the latter would have the advantage, if advantage it be, in such a climate, of less light and heat and more shade; while in a region less arid, with a much lower mean temperature, etc., the

greater proportion of light and heat which the southerly half receives, would give that side of the tree an advantage over the northerly half." In corroboration of this hypothetical explanation of Dr. Stearns, we may record the statement of Professor Budd, of Iowa, that in trees grown upon the prairies the thickness of wood is always greater upon the north side of the trunk than upon the south side. We shall be glad to hear from our correspondents upon this point.

A CLIMBING POLYPODIUM has been detected by that excellent botanical collector, A. H. Curtiss, on Key Largo. The species is probably *Polypodium Swartzii* Baker, and its discovery is a most interesting one, giving another fern to Florida, and carrying our list of North American ferns up to 156.

Subscribers for Mr. Curtiss' plants will be glad to know that he has not only collected enough of the new fern to supply all of his sets, but that he has also collected fine specimens of *Asplenium serratum* as well.

Soon after an Ophioglossum, which proves to be *O. nudicaule* L. fil., collected by Dr. Parry, came to hand from California, adding another species to the flora of that State.—*G. E. Davenport.*

ZOÖLOGY.

THE OCCURRENCE OF MEPHITIS INTERRUPTA RAFINESQUE IN NORTH CAROLINA. — During the past summer I spent several weeks in the neighborhood of Roan mountain, N. C., an interesting region to any one having a taste for natural history matters. Here I found the *Pitys bryanti* Harper, the *Margaritana ravenelliana* Lea, the rare new Helices recently described by Mr. Binney, and last, but not least, here I killed and skinned a fine specimen of the rare *Mephitis interrupta* Rafinesque.

The synonymy of this species is fully set forth in Dr. Coues' Fur-bearing animals, which he heads *Mephitis* (*Spilogale*) *putorius* (L.).

Speaking of Rafinesque's claims to the species he says: "The *Mephitis interrupta* of Rafinesque may or may not have been "a pure figment of his imagination." It probably, however, had some basis, and even if his account does not wholly agree with specimens of *Spilogale putorius* examined, it will be remembered that even his elastic imagination would be put to the stretch to describe a spotted and striped skunk in terms too exaggerated to be met by the reality which this species offers. We may accept his name as undoubtedly belonging here, and in fact we should adopt it, as a more definite appellation than Zorilla, were it not anticipated by Linnæus as just shown."

Dr. Coues, in a recent letter to me, says, "the species undoubtedly belongs to Rafinesque."

It is a well-known fact that Rafinesque was, for a long time, Professor of Natural History in the old Transylvania University at Lexington, Kentucky. He made frequent excursions on foot through the wildest portions of the State, in pursuit of his favorite studies. As this little animal occurs so far north in the Appalachians as the northern line of North Carolina, it is within the range of Rafinesque's explorations without a doubt. He had doubtless seen it often, and if he may have mixed localities in regard to this animal, it is no more than all early students of our fauna did, and none to a greater extent than those who have been his most uncompromising critics.

This skunk is said by the inhabitants to be quite common at Roan, although this is the only one which I saw. The *M. mephitica* also occurs, and a semi-melanotic variety of the *Sciurus hudsonicus*. This beautiful little squirrel is less reddish than the northern variety, has a white belly and the lower half of the body, on each side, between the fore and hind legs, and shading off on the hips and shoulders, very dark—nearly black in well-marked specimens. It is considerably larger than the northern "pine squirrel," but has the same habit of choosing evergreen trees for its abode. The native people call it the "mountain boomer."—*A. G. Wetherby.*

NOTE ON GADINIA EXCENTRICA TIBERI.—Twelve years ago I pointed out that this species was probably not a Gadinia, and did not belong to the Pulmonata, but until recently I had never seen a specimen. One just sent by Dr. J. Gwyn Jeffreys from the Mediterranean proves on examination to be a species of Addisonia (Rhiphidoglossa) closely allied to if not identical with the *A. paradoxa* Dall, recently described from the deep sea bed off the coast of New England. The close resemblance or identity of so many Mediterranean recent and Pliocene Italian forms with those living in the deep sea, is one of the most interesting features of geographical distribution.—*W. H. Dall.*

MOLLUSCAN NOTES.—On August 26, 1880, I found in the Hudson river, near Catskill landing *Lioplax subcarinata* Say, quite abundant. This I think is a new locality for this species.

On Sept. 22, 1881, I found *Littorina littorea* Linn., on rocks at Lloyds Neck, Queens county, Long Island. I believe this to be the first taken on the Long Island side of the sound.—*Henry Prime.*

HABITS OF THE WOODCOCK.—While out hunting Wilson's snipe, April 1, a specimen of American woodcock *(Philohela minor)*, was flushed from a clump of persimmon trees on the border of a slash. Knowing that the bird has the habit of rising above a clump of bushes and then suddenly dropping behind it out of range, and also aware of its rapid movements, I fired as soon as it rose in view. When the smoke cleared away I observed my bird slowly

rising with laborious flight and concluded it was wounded and expected to see it fall. (It is not uncommon for birds shot through the heart to rise quite high in the air and then suddenly drop dead.) When up about a rod high the bird turned and flew near me. My attention was called to something it seemed to be holding between its feet, and so heavy that its flight was slow and clumsy like that of a rapacious bird with heavy prey. By close observation I was convinced that the bird was transporting its young, as I could distinctly see the little fellow (about the size of a young chicken just hatched), located between its mother's legs and supported by her feet placed on its sides. I became so interested in watching this habit, entirely novel to me, that I forgot to fire the other barrel until the bird was out of range, and then I felt that a bird showing such love of offspring ought to go free. So slow was the flight that by taking a brisk trot I was able to gain on the bird, and tried to tire it out and make it drop its precious burden, but its pluck was greater than my wind. After chasing it forty rods or more it started across a cultivated field and kept wing until reaching the other side, when it disappeared in a clump of bushes over one hundred rods from the place it rose.

It seems rather early for woodcock to hatch, but in this region where the winters are open woodcock and Wilson's snipe both remain. I shot a specimen of the former this spring in February and fifteen of the latter about the middle of January.—*F. L. Harvey, Ark. Ind. Univ., Fayetteville, Ark.*

Feline Development.—It seems to me from the many articles I meet with in scientific journals, as well as in the general press, and from my own observations, too, that the cat family are constantly growing in the general estimation in the high qualities of sagacity and affection. In fact, I believe, they stand better than they did forty years ago—all the objurgations of Mrs. Swisshelm, the champion cat-hater, to the contrary notwithstanding. Here is our "Nig," for instance, manifesting a trait altogether new, as it seems to me—in this: he likes to ride as well as a coach dog. He cries almost every day to ride to town in the buggy, and is always ready to go out with the team when we are hauling in hay or grain or husking corn, provided he can ride. If one will hold him in his arms he also delights to ride on horseback. His pleasure is manifested in a remarkable degree whenever he is allowed the luxury of a ride, either in any kind of vehicle or on horseback, and his cries are altogether pitiful when he is told that he cannot go. This singular habit seems to have been a natural one with him, for he never had any special training in that direction. While cats are ordinarily frightened out of their wits by any attempt to give them such a ride, our "Nig" is never so happy as when he is thus indulged. He evidently reasons that

if it is a good thing for people to "jump into a wagon and all take a ride," why don't the same rule apply to black cats? He would come pretty near accepting a railroad pass.—*Charles Aldrich, Webster city, Iowa, Jan. 31, 1882.*

Development of the Sturgeon and the Homologies of the Vertebrate Brain.—In a second paper by Salensky on the embryology of the sturgeon, according to the Journal of the Royal Microscopical Society, the author after describing the mode of development of the central nervous system, raises the question of the homology of this region with the nervous system of Vermes and Arthropoda. He points out that (1) the central nervous system of all vertebrates is formed from two thickenings of the ectoderm set parallel to the long axis of the body; that of all articulates has a similar origin. (2) In some cases, *e. g.* Echiurus, the articulates present a median groove comparable to that of vertebrates. (3) The formation of the medullary groove begins, in the case of both phyla, posteriorly, and is continued forwards. On the other hand the Vertebrata have the central nervous system dorsal in position, and the medullary groove becomes closed. As to the first of these, Salensky points out that the position of the mouth is the determining character in conjunction with that of the locomotor organs; these points he looks upon as having less morphological value than the development of the system, and its correlation with other organs during the course of development. The closure of the medullary groove is regarded as being merely the result of further modifications.

If we accept the general homology, we have next to determine how the parts correspond; the author cannot follow Dohrn and Hatschek in regarding the homology as being complete; he looks upon the brain of vertebrates as being a new formation, which is their exclusive property; it merely consists in an elongation and dilatation of the already existing nervous system, or in other words the medulla, which is the analogue of the ventral ganglionic chain of the Articulata.

Recent progress in the Study of Worms.—Several papers devoted to the higher worms, of a high order and with excellent illustrations, have lately appeared in Germany. The development of Polygordius and Saccocinus, two low chætopods has been described by Repiachoff. The Gephyrean worms have, however, received special attention. In an elaborate memoir on the Echiurida in the Nova Acta of Halle, by Professor Greef, the anatomy of the group is discussed with fullness, aided by colored drawings of transverse stained sections. The presence of a central canal in the nervous system is noted, and it is suggested that it is a remnant of the ectodermal invagination. A full account is also given of the curiously minute male of Bonellia. The author thinks that there is no close genetic affinity between the

Gephyrea and the Echinodermata, but that the former represents a distinct class allied to the Annelids and divisible into an armed (Echiurida) and unarmed (Sipunculidæ) group. In his elaborate account of the anatomy of *Sipunculus nudus*, Dr. Andreæ (*Zeits. Wissen. Zoologie*, XXXVI, 1881) expresses similar views as to the relations of the Gephyreæ.

On the other hand, Dr. Vejdovsky has studied very carefully Sternaspis, a form intermediate between the Gephyrea and Chætopods. His memoir appears in the Denkschriften of the Vienna Academy. He concludes that there are four natural orders of the class Annelides: 1. *Hirudinea;* 2. *Oligochæta; Polychæta;* and 4. *Gephyrea.* He derives the first two from the Discodrilida, and the other two from Sternaspis; the Discodrilida he considers form an offshoot from the Oligochæte stem, which descends into the Amedullata, which, with Sternaspis, have their common origin in the Turbellaria, which in turn are derived from the Cœlenterates. He also believes that the larvæ of the Chætopods and Gephyrea are formed on the same type, and that in Echiurus there is a true segmentation of the body.

Nervous System in Tape-worms.—The Cestodes, or tape-worms are usually described as having no nervous system. On investigation by transverse sections, Dr. A. Lang finds in the Tetrarhynchi a band-shaped cerebral mass with two longitudinal trunks which arise from the brain, and which give off lateral branches, the separate fibers of which enlarge here and there into very long and large ganglion cells. In Amphilina, an unjointed Cestode, the nervous system has a not inconsiderable resemblance to what obtains in the Trematoda.

Finally, says the Journal of the Royal Microscopical Society, Dr. Lang sums up the state of our knowledge as to the nervous system of the other Cestoda. *Tænia perfoliata* has a better developed nervous system than the rest of the Tæniadæ; the anastomosis or cerebrum contains nuclei and fibrils, gives off two lateral primary trunks, and completely resembles in structure the same parts in the Nemertinea. *Tænia solium*, with others, has three cords on either side. In the Bothriocephalida the water vessels are on the outer side of the longitudinal nerves, and here also the anastomosis is concave anteriorly; in the Ligulida the connecting commissure forms a pretty broad bridge, the lateral trunks lie outside the water vessels, and are approximated towards one another in the anterior region of the body.

Simroth's Nervous System and Locomotion of German land and fresh-water Mollusks.—This important article appears in the programme of the Realschule of the second order at Leipzig, and is an able discussion of the principal types of nervous system in these mollusks, with remarks on the physiology of locomotion. The plate is an excellent piece of work.

ZOOLOGY IN FRANCE.—The late numbers of Lacaze-Duthier's Archives de Zoologie contain some notable essays. Perrier's studies on the earth worms, made use of by Darwin in his last work on the earthworm, is beautifully illustrated by chromolithographs, the French maintaining their reputation for exquisite illustrations and delicate anatomical dissections. Numbers of the Acinetæ are described and illustrated by E. Maupas, while the notes on the anatomy of the brain of the mole, by W. Vignal, is accompanied by excellent figures. A. Schneider describes and figures a number of new psorosperms, while Dr. Yung discusses the innervation of the heart and of the action of poisons on the lamellibranchiate mollusks. The last number issued (No. 4, 1881) contains elaborate studies on the Pycnogonids, with several plates, by Dr. Hoek.

Milne-Edwards' *Annales des Sciences Naturelles* contains a summary of Mr. Walcott's work on the trilobite, by the venerable H. Milne-Edwards, who concludes that the trilobites are Crustacea, while he regards Limulus and the Merostomata in general as Arachnids. He accepts Walcott's determination of the nature of the limbs of trilobites. The same number also contains Robin's elaborate memoir on bats, with a figure of an embryo bat, and besides other papers, a second installment of A. Milne-Edwards researches on the fauna of the southern regions, concerning the distribution of the albatross, etc.

DEVELOPMENT OF THE PAIRED FINS IN SHARKS AND SKATES.—The latest contribution to this subject is that of Professor Balfour, who states that in Scyllium these arise as slight longitudinal ridge-like thickenings of the ectoderm. Afterwards the fins become a ridge of mesoblast covered by epiblast (ectoderm); the embryonic muscle-plates grow into the bases of the fins, and form two layers, while in the intermediate indifferent mesoblast changes begin which give rise to the cartilaginous skeleton. There is thus formed in the fin a bar, which springs at right angles from the posterior side of the pectoral or pelvic girdle, and runs parallel to the long axis of the body. The free end of this bar begins to undergo segmentation into rays. We have then a longitudinal bar along the base of the fin, which gives off perpendicularly a series of rays which pass into the fin. The resemblance to the arrangement of the unpaired fins is consequently very striking, and support is given to the author's original doctrine of a once continuous lateral fin.

MR. STEARNS ON VARIATION IN AMERICAN PLANORBES.—Apropos of Mr. Hyatt's article in the June number on the evolution of Tertiary species of Planorbis, we have in the Proceedings of the Academy of Natural Sciences, Phila., 1881, a most interesting paper by Mr. Stearns: (1) as to whether the shells of Planorbis are dextral or sinistral, and (2) on certain aspects of variations in American

Planorbes. The larger so-called species of Planorbis are divided into two groups. *First*, those in which the whorls are rounded; that is to say if the tube or cone, as represented in the preceding part of the paper, was cut transversely, the section would show a rounded (not round) outline. Examples are the typical *P. corneus* L. of Europe, *P. guadaloupensis* Sby., *P. subcrenatus* Carp., and *P. tumidus* Pfr. of Nicaragua, a quite persistent form, not, however, quite as rounded as the others. *Second*, those in which the whorls are either planulate, angulated, carinated or sub-carinated, which includes most of the larger North American species: examples are *P. corpulentus* Say, *P. traskii* Lea, *P. occidentalis* Carp. and *P. bicarinatus* Say. In these the tube, if cut transversely, would present an outline more or less angulated. Forms like *P. trivolvis* connect the two groups, for while in some instances this species exhibits the rounded whorls of the first it imperceptibly differentiates from the above to obtuse angulation, and thence to the sub-connate forms of the second group. Further remarks in illustration, with references to variations in other species, follow.

Researches on the Comparative Structure of the Cortex Cerebri.—In the Philosophical Transactions of the Royal Society of London for 1880, Dr. W. B. Lewis details the results of a full investigation into the minute structure of the cerebral cortex in the pig, with notes upon the histology of the same structure in the sheep and cat, with a view of comparison between the brains of these animals and that of the highest members of the mammalian series. The general arrangement of the cells constituting the greater portion of the cortex of the brain of the pig, is very similar to that found in the highest Mammals, and the cortex of the sheep closely resembles that of the pig. Among the chief facts of interest elicited are the following: A five and six laminated cortex is found in all, the fundamental structure of the layers is similar, and divergence in type is induced through the varied character and distribution of the units of these layers. Variations in laminar type, whether in man or the lower animals, center about the mid-region of the cortex; and motor areas are characterized by a five-laminated cortex and nested cells. In the cat the cells of the third layer increase in size with their depth, and the ganglionic cells are very large and crowded around the crucial sulcus—this concentration is a feature of importance in the Carnivora, and distinguishes them from the pig and sheep, in which the ganglionic cells are widely spread and uniform; and from man and the apes, in which they are widely spread and varied in development. The ganglion cells of the sheep and pig differ wholly in type from those of the higher mammals, and approach closely in appearance the large pyramidal cells of the third layer in man and the ape.

CONCLUDING OBSERVATIONS ON THE LOCOMOTOR SYSTEM OF MEDUSÆ.—Mr. G. J. Romanes has, by his experiments upon Medusæ, done much to explain the nature and origin of nerve action. It is in the Medusæ that we have the first observed appearance, in the ascending scale of life, of both muscular and nervous elements, and fortunately the creatures exhibit much endurance under experimentation, and are, many of them, of considerable size. A startling result of Mr. Romanes' labors, is his conclusion that ganglionic action is not, by itself, adequate to explain rhythm. Rhythmic action is the rule in the lowest forms of animal life; the beautifully regular motions of some Algæ, Diatoms and Oscillatoriæ, of the Infusoria, etc., are certainly not due to ganglia—not the least vestige of a ganglion can be traced in the snail's heart; and it would be hard to decide in what respect the beating of the snail's heart differs, on the one hand, from that of the pulsatile vessels of the Infusoria, or, on the other, from that of the mammalian heart. This being the case, why, Mr. Romanes asks, should the rhythmic action of the latter be referred to the ganglia present in it? Does it not seem probable that those contractile tissues endowed with rhythmic action in the higher animals are those which have retained their primitive endowment of rhythmicality? The paralyzed nectocalyces of Medusæ yield a rhythmic response to stimulation, whether electrical, mechanical or chemical, but while the covered-eyed Medusæ respond most readily to faradaic stimulation, some of the naked-eyed Medusæ are acted on most powerfully by the constant current, as well as by mechanical and chemical stimulation. The effect of temperature upon the rate of contraction exhibited by tissues deprived of their ganglia (artificial rhythm) was exactly parallel with its effect upon the natural rhythm of the motions of the unmutilated tissues, and this leads up to the probability that the effects of temperature on the natural rhythm of the ganglio-muscular tissues of other animals are for the most part exerted on the contractile element instead of on the ganglionic.

The introduction of oxygen gas into the water containing the parts under the action of electrical stimulus, increased the rate of contraction, while carbonic acid gas diminished it. The removal of the periphery of the swimming-bell of Sarsia, with its accompanying ganglia, causes great elongation of the polypite. The same thing occurs in some other Medusæ, but to a less extent. Thus the polypite is normally in a state of tonic muscular contraction from the persistent ganglionic stimulation, while the bell, under the same stimulation, exhibits rhythmic action. This difference is believed to result from the greater irritability of the polypite, which is evident in whatever way a stimulus is applied. But as the artificial rhythm induced by stimuli is but a feeble substitute for the vigorous movements of the healthy animal, Mr. Romanes concludes that the ganglionic discharges are timed to coincide with the rhythmic action of the contractile tissues, due to

alternate exhaustion and restoration of excitability, and thus nervous energy is economized. Thus, in creatures not possessed of ganglia, rhythmic action results alone from this alternate exhaustion and restoration of muscular excitability, causing the constant stimulation to alternately fall below and rise above the limits of adequacy.

OVA OF ECHIDNA HYSTRIX.—Professor Owen has examined the ova of two specimens of *Echidna hystrix* as they occurred *in situ*. The ova increase in size prior to embryonal development, attaining a diameter of six millims., but evidence of the viviparity of the animal is found in the commencement of the fissure of the germ-mass. Previous observations have proved that the teatless mammary glands acquire large development during gestation, and that the lacteal aureola becomes lodged in a tegumentary depression or *quasi* pouch, capable of receiving the head and fore limbs of the young when this is not more than one inch ten lines in length.

ZOOLOGICAL NOTES.—Professor Haeckel has returned from his expedition to Ceylon, and has sent over fifty cases of specimens to Jena. His researches on the Ceylon coral reefs were highly successful.——M. Thury has published a hypothesis on the origin of species in the Archives des Sciences Physiques et Naturelles, Feb. 15.——In a recent communication to the French Academy, M. Huet records the discovery of segmental organs in certain isopod Crustacea.——It appears, says *Nature*, that Mr. Arthur having lately examined trout introduced into New Zealand from eggs originally obtained from the Thames, England, found that the annual increase of weight had risen from 1½ to 2½ pounds, and an example had been seen weighing twenty pounds. The cœcal appendages, hitherto held as significant of species were found increased from thirty-three to fifty, as exemplified in British fish, to from forty-three to fifty-four in the New Zealand examples, showing that these organs are inconstant as to numbers. These fish, moreover, living in different streams in New Zealand, had also assumed local peculiarities of size and change of form.——The U.S. Fish Commission is issuing the first volume of its Bulletin; the pages received contain, among others, some excellent articles by Mr. J. A. Ryder, on the breeding habits and development of the four-spined stickleback, the Spanish mackerel, the shad and the sea-horse (*Hippocampus antiquorum*). He states that the bony fishes differ in their mode of development from other vertebrates and fish-like animals except the sturgeons, in having a persistent segmentation-cavity which extends under the head to form the heart. The true gastrula of Teleosts appears to originate as an invagination at the tail of the embryo, represented by Kupffer's canal, essentially the same as in Amphioxus, and is not homologous with the gastrula regarded as such by Haeckel. The paired fins originate from lateral folds, and the first skeletal elements of the breast fins in the cod are a pair of curved cartilaginous arcs or rods.

ENTOMOLOGY.[1]

INSECTS AND DROUTH.—The year 1880 is known to have been phenomenal in the excessive drouth which prevailed in spring and early summer in the New England States. In a yet unpublished account of the disastrous work of the Army-worm that year (contrary to the old theory that it can abound only in a wet summer) in Monmouth county, New Jersey, Rev. Samuel Lockwood, of Freehold, speaks as follows of the exceptional abundance of other species:

"As for that Colorado pest, it was out early and in vast numbers, and by June 1st the Striped beetle (*Lytta vittata* Fabr.) fell upon the potatoes in hordes so vast that some farmers, because of the activity and numbers of the insect, declared it more formidable than the Colorado scourge. And that queer beetle, *Macranoxia variolosa* Hentz, so rare that I had never yet heard of one in Monmouth county, appeared in the first week of June at Red Bank, in quantity. In the same week our clouded yellow butterfly (*Colias philodice* Godart) made a premature appearance in immense swarms. Another sight which affected me because of its novelty, was the occurrence in great numbers, in the openings of "The Pines," in the second week of May, of a low flying brown butterfly like a Hipparchia. Tempting as the scene was, I was too ill that day to get out of my carriage for a butterfly hunt. But enough has been stated to show that from every point 1880 was, for New Jersey, a phenomenal year."

PROBABLE SOUND ORGANS IN SPHINGID PUPÆ.—In recently characterizing the pupa of *Sphinx catalpæ* Boisd., for our report as entomologist to the Department of Agriculture, we were struck with the occurrence on the anterior border of each of the larger, movable, abdominal joints (viz: abdominal joints 5, 6 and 7) of a peculiar, elongate concavity, a structure not mentioned by Westwood, Burmeister, Kirby, Spence, Girard, Clemens, Harris, Graber or any modern author whom we have been able to consult. There is an approach to it in the pupa of *Ceratomia amyntor*, and it occurs in that of *Sphinx harrisii*, in similar position and form as in *catalpæ*. In *Macrosila 5-maculata* it is somewhat above the spiracles, and that on the fifth abdominal joint has a second larger ridge running around it posteriorly. It does not occur in any of the species of the genera Sesia, Thyreus, Darapsa, Deilephila, Philampelus and Smerinthus in our collection. It has no internal connection with the respiratory or circulatory systems and its function is probably sound-producing by friction with the posterior margin of the preceding joint.

This organ may in fact throw some light on the method by which the noise is produced which the pupa of *Sphinx atropos* is

[1] This department is edited by Professor C. V. RILEY, Washington, D. C., to whom communications, books for notice, etc., should be sent.

known to be capable of. Unfortunately we have no pupæ of that species for examination. We shall be glad to learn from any of our lepidopterological readers if they are familiar with this structure in any other pupæ, or know of any record of it.—*C. V. Riley.*

Clover Insects.—In his paper upon the insects of the clover plant, read before the N. Y. State Agr. Society, Jan. 19, 1881, Professor J. A. Lintner enumerates but three species of Coleoptera as being destructive to the plant.

From personal observation I am now able to more than double the number, the revised list being as follows:

Hylastes trifolii Muller (larva in roots).
Languria mozardi Fabr. (larva in stem).
Graphorrhinus vadosus Say (imago on leaves).
Lachnosterna serricornis Lec. (imago on blossoms).
Macrobasis unicolor Kirby (imago on leaves).
Colaspis brunnea Fab. (imago on leaves).
Epicærus imbricatus Say (imago on blossoms).

The latter four species are my contribution to the list, all old offenders, and well known to the economic entomologist.

None of these have so far become to any extent destructive, the Colaspis approaching nearest thereto. But as yet clover culture is in its infancy in the West, hence if the acreage were largely multiplied, the results can now be only a matter of supposition.—*F. M. Webster.*

Is Cyrtoneura a Parasite or Scavenger?—Last spring we sent specimens of a Muscid for determination to Mr. R. H. Meade, Bradford, England, and he kindly wrote us as follows regarding this species which was bred from chrysalides of the Cotton-worm:

"The Dipterous insects which I received yesterday are one male and two females of *Cyrtoneura stabulans* Fallen. This fly is common throughout Europe, and also occurs in North America, according to Loew and Walker (see Osten Sacken's Cat. of Dipt. of N. A., edit. 2d, p. 163). The larvæ usually feed upon decaying vegetable substances, as fungi, etc., but Schiner (Fauna Austriaca, Dipt., Vol. 1, p. 597) says, according to Bremi and Hartig, they also live upon the larvæ of Lepidoptera and bees. It is a very interesting fact that they also eat the Cotton-worms. Your American specimens seem to be perfectly identical with my British ones, but are rather smaller. I may add that the genus Cyrtoneura Macq. belongs to the family of the true Muscidæ."[1]

There can be no doubt that the Cyrtoneuras we bred issued from pupæ of Aletia, but as the usual habits of the species are those of a scavenger, some doubt has arisen in our mind as to

[1] Vide also Mr. Meade's note on the same subject in the (London) *Entomologist*, June, 1882, pp. 140–141.

whether it is a true parasite. We recall to our readers another Dipterous insect, the *Phora aletiæ* Comstock, which has been called, by its describer, one of the most important parasites of the Cotton-worm, and which nevertheless turns out to be a mere scavenger. *Cyrtoneura stabulans* may, like this Phora, lay her eggs on the decaying pupæ of Aletia, which are so commonly met with at the time the worms have defoliated the fields and have also eaten the leaves which sheltered the chrysalides. These chrysalides when exposed to the light and heat of the sun are very liable to rot, and on examining the chrysalides hanging on the defoliated plants, by far the larger portion of them will be found to be rotten, many containing the larvæ of Phora, some the larva of this Cyrtoneura, while the largest portion contain only a badly smelling fluid. If further observations prove that this fly infests only such chrysalides and cannot be bred from the living Aletia larva, it cannot be considered a true parasite.—*C. V. Riley.*

Habits of Polycaon confertus Lec.—There seems to be nothing recorded on the habits of the genus Polycaon beyond a short notice in Dr. Horn's Revision of the N. A. species of Bostrichidæ,[1] that *P. confertus* "occurs in California where it is said to depredate on grape vine." We lately received from Mr. Matthew Cooke, of Sacramento, Cal., some pear twigs in which the above-named beetle was boring in exactly the same manner as our common Apple-twig borer, *Amphicerus bicaudatus*. Mr. Cooke says that the Polycaon is quite injurious to apple and pear trees and also to the grape vine. Thus, from what we know of its natural history, we may safely infer that its habits do not differ essentially from those of *Amphicerus bicaudatus*, *i. e.*, the beetle bores for feeding purposes in living twigs of fruit trees and grape vines, never, however, ovipositing in such twigs, and both male and female being concerned in this destructive work. Both species live, in all probability, as larvæ in the dead and dry wood of forest trees.

Dinoderus pusillus as a Museum Pest.—While speaking of the habits of Bostrichid beetles, we would mention that last year we made the acquaintance of the above-named species in the role of a museum pest, it being usually met with in various drugs and other stored and dry vegetable products. The beetles suddenly appeared in large numbers in one of our insect boxes which had not been used for many years, perforating the paper lining and evidently feeding on the cork with which the box was lined. How the beetles came in the box remains a mystery to us, for the box was made and lined nineteen years ago and the insect had not appeared previously.—*C. V. R.*

Myrmecophilous Coleoptera.—In connection with our remarks on *Coscinoptera americana* in the last number of the Nat-

[1] Proc. Am. Philos. Soc., Vol. xvii, p. 554.

URALIST, we would mention that while several species of the genus Cetonia (*C. ænea* and *C. aurata*) are known in Europe to live in the larva state among ants, and while it is also known that the species of Cremastochilus are true myrmecophilous insects, yet nothing has been recorded of the earlier stages of Euphoria, though some species are among our most common beetles. Mr. Laurence Bruner now communicates to us from West Point, Nebr., that he finds *Euphoria hirtipes* Horn—larvæ as well as beetles—quite commonly in the hills of the common red ant (which in all probability does not differ from the European *Formica rufa* Linn.). There is scarcely any doubt that other species of Euphoria will have the same habits. The only other myrmecophilous Scarabæid known from the U. S. is *Euparia castanea*, which is very commonly met with in the Southern States in the nests of *Solenopsis xyloni* McCook, the so-called stinging ant of the cotton fields.

Mr. Theo. Pergande made an interesting observation the past spring on *Hymenorus rufipes*. He found its pupæ in the hill of a large, black, sericeous ant (*Formica fusca* Linn.), and the pupæ of another species of Hymenorus, *H. obscurus* Say, in the nest of a large yellow ant under a stone, but which cannot be named at present. The great care and attention bestowed by the ants upon the pupæ of the beetles when the nests were disturbed, seem to show that the pupæ were not in the nests of the ants by accident. Further observations are necessary to establish the fact, but as myrmecophilous Tenebrionidæ are known, and as an undescribed species of Anthicus is undoubtedly an inquiline of the red ant in Colorado, we should not be surprised if these species of Hymenorus would prove to be myrmecophilous in their earlier states.

Mr. E. A. Schwarz, who has collected largely in ants' nests, and who has many unpublished facts, will, we hope, ere long give us a list of all N. A. Coleoptera known to live among ants. —*C. V. Riley.*

DISCONTINUANCE OF PUBLICATION.—We are advised by the publisher of the *Revue Coleopterologique* of the discontinuance of this periodical. When we noticed in these columns (p. 152) the appearance of the *Revue*, we hoped that it would cover the whole subject of coleopterology, thus furnishing to the specialist, at short intervals, that information which the *Zoological Record* and the *Zoologischer Jahresbericht* give only in very condensed form at long intervals. However, the magazine greatly disappointed us as it was evident that the managers were too much absorbed in lists of "new species," synonyms and the other dry bones of the science to create any general interest in its pages. The result just announced was, it seems to us, but natural.

ANTHROPOLOGY.[1]

INDIAN LANGUAGES OF THE PACIFIC STATES.—In the April number of the *Magazine of American History*, Mr. Albert S. Gatschet gives us a paper upon some of the Pacific coast tribes and upon the Pueblos. The classification of the tribes west of the Sierras is known to have been fraught with great difficulties. We are indebted to Mr. Hale, Stephen Powers and Mr. Bancroft for much help. The Bureau of Ethnology has afforded Mr. Gatschet the opportunity of extending greatly our information. The following is a brief abstract of the paper:

Mutsun family.—The Esselen, or Eslens, identical with the Huelels of La Soledad mission, and the Karkins of Carquinas straits, belong to the Mutsun family, as also did the dialects of the *rancherias* Saclan, San Juan Bautista and Juichum. The idioms spoken by Powers' Miwok tribes are Mutsun. In fact, dialects of Mutsun extended from the Pacific coast across California to the Sierras.

Wintun family.—The Suisunes north of the San Francisco bay are Wintun, but at the mission San Juan Bautista, the colonies of Nopthrinthres and Lathru-unum were Yokuts.

Chimariko family.—East of Trinity river. Habitat and characteristics given. No divisions.

Washo family.—Nevada. Area and quality but no divisions mentioned.

Kalapuya family.—Willamet valley. Divisions: 1. Atfálati (Tuálati, Wápatu); 2. Yamhill; 3. Lukamayuk; 4. Kalapuya; 5. Ahautchuyuk, or Pudding river Indians; 6. Santiam (Ahálpam, Uplanders); 7. Ayaukeld (Yóukalla).

Yakona family.—Coast between Capes Foulweather and Perpetua. Two dialects, the Yakona and the Alseya.

Sayuskla family.—Habitat and qualities given. No divisions.

Kusa family.—Coos river and bay. No divisions.

Takilma family.—No divisions.

Pueblo Indians are divided into four families:

Rio Grande family.—1. Taos language, spoken at Taos and Picori; 2. Taño language, spoken at Isleta, Isleta del Paso and Sandia; 3. Téhua language, spoken at Tesuque, San Ildefonso, Nambe, San Juan or Ochi, Santa Clara, Pajoaque, Los Luceros, and at the Moqui village of Tehua; 4. Jemes language, on Jemes river, consolidated with Indians of Old Pecos; 5. The Piro language, spoken at Sinecu, a few miles below El Paso del Norte.

Kera family.—Spoken at San Domingo, east of the Rio Grande and west of that river on the San Juan and its tributaries. The Pueblos are: 1. The Kawaiko group on the San Juan river—Laquena, Acoma, Hasatch, Povuate and Moquino; 2. The Kera or

[1] Edited by Professor OTIS T. MASON, 1305 Q street, N. W., Washington, D. C.

Queres Pueblos on or near the Rio Grande, north-east of the former—Santa Aña, Cia, Silla, San Felipe, San Domingo and Cochiti.

Zuñi family.—At Zuñi Pueblos.

Moqui towns.—The language of one of the Moqui towns, Tehua, has given name to a linguistic family, the other towns Tsitsúmovi, Hualpi, Mushánganevi, Shebuálavi, Shongápavi and Oraévi speak Shoshoni dialects. Mr. Gatschet is a very patient, scrupulous student, and his labors in disentangling the Indian languages of our continent, cannot receive too high a praise.

GEIGER'S DEVELOPMENT OF THE HUMAN RACE.—From the press of Houghton, Mifflin & Co., of Boston, appears a work entitled "Contributions to the History of the Development of the Human Race," by Lazarus Geiger, translated by David Asher, and forming volume xx of the English and Foreign Philosophical Library. One not acquainted with the studies and works of Dr. Geiger would not guess what the volume is about. It should be named, the contribution which the study of language makes to our knowledge of the early history of man. From this point of departure the author seeks to unravel such mysteries as the evolution of technique, the color sense, the origin of writing, the discovery of fire, and the primitive home of the Indo-Europeans. It may be that the author generalizes too hastily here and there. For instance, the absence of allusions to fragrance in the Bible previous to the "Song of Songs," is supposed to teach that the sense of odor is not innate in man but has gradually had an evolution. In a much stronger sense the perception of colors has grown upon the human family, and this accounts for the lack of all mention of the color *blue* in the Rig Vida, the Zendavesta, the Bible, and the Homeric Poems. Indeed, Dr. Geiger lays down a law as to colors, that indifference with respect to the intermediate ones rises as we approach primeval ages, to an ever increasing degree, until at length only the outermost extremes, black and red, are left.

The freshness of thought and the suggestiveness of these lectures render them one of the most valuable contributions to our modern anthropological literature.

THE SMITHSONIAN REPORT FOR 1880.—The restriction of Congress as to the number of pages in this time-honored publication having been removed, the volume for 1880, though somewhat delayed, appears in an enlarged form, having 772 pages. The contributions to anthropology occupy the usual space in the volume, although many original papers were crowded out. In the report of the secretary mention is made of Mr. Frank Cushing's residence among the Zuñis, Col. Stevenson's collections among the Pueblos, Ober's researches in the West Indies, Dall and Bean's expedition to Alaska, Boehmer's index to the Smithsonian pub-

lications in ethnology and archæology, the contents of Vol. XXII, Contributions to knowledge, and the archæology of the West Indies. On page 56 Professor Baird makes the following announcement, which will be welcome to many of our older anthropologists: "Among the collections which will form part of the objects in the National Museum, a very interesting and instructive exhibit will consist of the Indian portraits and scenes painted by the late George Catlin. These pictures were presented to the institution in 1879 by Mrs. Harrison, of Philadelphia." On page 62 will be found an account of the relations of the Bureau of Ethnology to the Smithsonian Institution. The destination of Dr. Berendt's papers on Guatemala is given on page 69. The list of contributors given on pages 110–135 contains the names of many who have added to the anthropological collections. With the present number a more systematic scheme of summaries in different sciences is begun. The paper upon the progress of anthropology is by the editor of these notes in the NATURALIST, pages 391–448.

COLONEL STEVENSON'S COLLECTIONS FROM THE PUEBLOS.—The readers of the NATURALIST are not unfamiliar with the very extensive collections which Colonel James Stevenson, of the Bureau of Ethnology, has been making during the past three years in the Pueblo country. There is now passing through the government press an illustrated descriptive catalogue of these objects. Part I, nearly ready, contains the enumeration of 2858 specimens of pottery, implements of war and hunting, articles used in domestic manufacture, clothing and personal ornament, basketry, horse trappings, images, toys, stone tools, musical implements, those for gambling and religious ceremonies, fabrics, foods, paints, pigments, medicines, dye-stuffs, &c. By far the best part of the collection is the pottery, which Mr. Stevenson divides into six classes: 1. The red or uncolored; 2. The brown ware; 3. The black ware; 4. The cream white decorated in colors; 5. Red ware decorated; 6. The ancient pottery. There are 350 illustrations to the report, nine plates of colored lithographs by Julius Bien, the remaining figures being woodcuts. Mr. Stevenson's catalogue is much more than a mere printed list. The descriptive text contains the observations of a man singularly gifted in winning the confidence of the savages, who allowed him to witness all the operations of their quaint industries, and to collect the materials and implements for all stages of their barbaric art. The best informed technologist will find something to awaken fresh thought on every page of Col. Stevenson's narrative. The most important part of the material was gathered at Zuñi, but valuable specimens are also enumerated from Wolpi, Laguna, Acoma, Cochiti, Santo Domingo, Tesuque, Santa Clara, San Juan, Jenez, Old Pecos, the Cañon de Chelley, the Jicarillas and from miscellaneous sources. Part II, now in course of preparation, will enter

more minutely into the distribution of industries and technical processes.

ANTHROPOLOGY IN GREAT BRITAIN.—We are in receipt of the May number of the *Journal* of the Anthropological Institute of Great Britain and Ireland, and of the fifteenth volume of the Transactions of the Victoria Institute. The former has an unusual amount of local matter, but the following papers will interest American readers:

On the animism of the Indians of British Guiana. By Everard F. im Thurn.
Notes on the Asiatic relations of Polynesian culture. By Edward B. Tylor.
On the stature of the inhabitants of Hungary. By Dr. John Beddoe.
Some vestiges of girl sacrifices, jar burial and contracted interments in India and the East. By M. J. Walhouse.
On the origin and primitive home of the Semites. By G. Bertin.
On some stone implements from British Guiana. By E. F. im Thurn.
President's annual address.

The Victoria Institute volume contains a paper by Dr. James C. Southall on Pliocene man in America, accompanied with remarks by J. W. Dawson, the Duke of Argyll, W. Boyd Dawkins, T. McK. Hughes and others.

ANTHROPOLOGICAL NOTES.—Professor Cyrus Thomas writes: "Applying to the inscription on the Tablet of the Cross the same method I have used to determine the order in which the characters of the Manuscript Troano are to be read, I discovered that the inscription is to be read in double columns from the top downwards. The demonstration of this I will give in my paper on the Manuscript Troano."——Col. F. F. Hilder, of St. Louis, is the author of pamphlet No. 6, published by the Missouri Historical Society, describing a remarkable vase containing devices indicative of sun-worship.——In the Bulletin of the Minnesota Academy of Natural Sciences, 1881, two papers of interest to our fraternity will be found: "Is the Dakota related to the Indo-European languages," by A. W. Williamson; "Classification of languages," by W. W. Folwell.——In the last volume of the Proceedings of the National Museum, pp. 455–458, will be found a list of all the anthropological publications of Dr. Charles Rau.——Under date of May 21, 1882, Mr. Henry L. Higginson presents his report as treasurer of the Archæological Institute of of America, showing a receipt of $12,560.95, and a balance of $2649.35. The following very important observation is made and should be seriously considered: "If the work is to be continued during the present year, it is apparent that the executive committee must be supplied with means in addition to what they will receive from the subscriptions of annual members."——Robert Clarke & Co., of Cincinnati, are the publishers of "Shea's Mississippi Series."

GEOLOGY AND PALÆONTOLOGY.

THE SOUTHERN LIMIT OF ANCIENT GLACIERS IN PENNSYLVANIA.—At a late meeting of the Boston Society of Natural History, Professor G. F. Wright, of Oberlin, O., gave an account of the discoveries made last summer by him and Professor H. C. Lewis concerning the southern limits of ice-action (otherwise called the terminal moraine) in Pennsylvania during the glacial age. These investigations were made under the direction of Professor Lesley, who has charge of the elaborate geological survey now in progress in that State. Previous to last summer Mr. Clarence King had, first in 1876, through a paper of Mr. Wright's before this society, called attention to the terminal moraine at Wood's Holl. Subsequently Warren Upham, taking up this clue, had followed it through Cape Cod and Long Island, where the line joined on to that discovered by Professor Cook, of New Jersey, reaching the sea at Perth Amboy just below New York, and crossing the Delaware river at Belvidere, a little above Easton, Pa. From this point the line of the terminal moraine was seen laid down upon a map fifteen by ten feet, displayed for the first time to a scientific society, crossing Northampton county by a general north-western course to the center of Monroe county; thence westward, crossing the Lehigh fifteen miles above Mauch Chunk, and the Susquehanna twenty miles below Wilkesbarre; thence by a northwesterly course through Columbia county, rising to the summit of the Alleghanies in Lycoming county and crossing them diagonally through Tioga and Potter counties, where the general elevation of the country is upward of 2000 feet. From Potter county the moraine enters Cattaraugus county, N. Y., and continues to trend northward as far as Little valley, six miles north of Salamanca, where it makes a sharp turn to the southwest, running nearly parallel with the Alleghany river to Columbiana county, Ohio. The whole length of the line explored this last summer is about 400 miles. The signs of glacial action abruptly cease along this line, and it is marked by a special accumulation of unstratified material composed of clay, scratched stones and granite boulders which have been transported hundreds of miles. North of that line the signs of glaciation are everywhere apparent; south of it there are no scratched stones, no transported boulders, and no "till" or boulder-clay. Where streams cut through the line, however, boulders of granite and quartzite have been transported by water and deposited in terraces and deltas. The gravel at Trenton, New Jersey, in which Dr. C. C. Abbott has found palæolithic implements, is in a delta terrace thus formed when the river was fifty feet higher than now. Every stream to the westward which rises in the glaciated region and flows through the unglaciated region, has formed corresponding terraces and deltas, and is full of interest. The lecturer urged that thorough search for palæolithic implements should be made

in all such formations. The majestic proportions of the great ice-movement are seen in the fact that it advanced as far south upon the mountains as in the valleys; for example, the valley between the Kittatinny and Pocono mountains,though twenty miles wide and one thousand feet deep, caused but a slight deflection of the ice-front to the south. The same is true where the moraine crosses the valley of the east branch of the Susquehanna. The grand deflection of the line to the northward is evidently due to variations in the forces which were pushing from behind. Now that an accurate knowledge of the southern limits of the continental glacier is being obtained, it will be possible to get a variety of approximate estimates of the quantity of erosion which has taken place since the great ice age, and so a more correct idea of its antiquity. Full accounts of this subject will appear in the report of the Pennsylvania geological survey. Arrangements are in progress for Mr. Wright to continue the exploration through Ohio the present summer.

NEW PHYLLOPOD AND PHYLLOCARIDAN CRUSTACEA FROM THE DEVONIAN OF NEW YORK.—A very interesting species of Estheria (*E. pulex*) is described by J. M. Clarke in the *American Journal of Science*. If this is a genuine Estheria (and it differs from other species in wanting a straight hinge margin) it is the oldest species of the genus yet found, though *E. membranacea* Jones, occurred in the Old Red of Caithness. In this country no species of Estheria has been found below the Trias.

The other forms described by Mr. Clarke are not true Phyllopods, but should be referred to the order *Phyllocarida*, being related to Discinocaris. They are forms of much interest. *Spathiocaris emersonii* Clarke, gen. et sp. nov., is from the Portage of Ontario county. The second form of this order, *Lisgocaris lutheri* Clarke, gen. et sp. nov., is from the base of the Hamilton, in the same horizon as *Estheria pulex*. The author refers it to the "Apus type of the Phyllopods," but are they not more properly allied to Nebalia, the rostrum having been lost or separated after death? Only the carapace of this genus and of *Spathiocaris* occured, the abdomen not having been discovered.

WHITE'S CONTRIBUTIONS TO MESOZOIC AND TERTIARY PALÆONTOLOGY.—Dr. C. A. White describes in the Proceedings of the U. S. National Museum, several new mollusks from the Laramie and Green River groups, which is succeeded by a short paper on the molluscan fauna of the Truckee group, including a new form.

In the *American Journal of Science* he discusses certain conditions attending the geological descent of some North American types of fresh-water, gill-bearing mollusks. Dr. White claims that the rivers of North America having existed from early geological times, that some of them becoming confluent, have disseminated molluscan forms. Thus the Ohio and Upper Mississippi, the

two most ancient portions of the present great system, were once separate rivers, emptying into a northern extension of the great gulf; and it is practically certain that neither of them received that portion of the molluscan fauna which now so strongly characterizes them, until after the confluence with them of the western portions of the present great river-system which brought that fauna from its ancient home in the western part of the continent." He concludes that "a large number of the types among the Mollusca of the Mississippi drainage system have come down wholly unchanged from a time at least as remote as the Laramie period.

WHITFIELD'S NEW SPECIES OF FOSSILS FROM OHIO.—This pamphlet contains descriptions of numerous new species of mollusks from the palæozoic rocks of Ohio, which are to be republished accompanied by illustrations, in the forthcoming volume of the palæontology of Ohio. Among the more interesting novelties is a new Eurypterus.

DAVIS ON THE LITTLE MOUNTAINS EAST OF THE CATSKILLS.—The first number of the third volume of "Appalachia," contains an account of the interesting and varied geology of the Little Mountains, a region attractive to tourists. The illustrations accompanying the article are clear and excellent of their kind.

GEOLOGICAL NOTES.—At a recent meeting of the London Geological Society, J. S. Gardner communicated a note upon the geology of Madeira. In the center of the island is a horse-shoe shaped valley, more than 2500 feet above the sea, with walls 3000 or more feet in height. This the writer regarded as the basal wreck of a volcanic mountain.——In the June number of the *Geological Magazine*, W. H. Hudleston continues his contributions to the palæontology of the Yorkshire oölites; W. Keeping writes upon the glacial geology of Central Wales, and mentions that Aberystwith beach is rich in agates, onyx, felsites, and other stones that cannot have come originally from any part of Wales, but are probably washed by marine currents out of a boulder-clay now submerged in Cardigan bay; C. Davison contributes an article on the theory of vorticose earthquake shocks; and the Rev. A. Irving continues his notes on the classification of the European Permian and Trias. Mr. Davison considers that vorticose and twisting shocks are due to the facts that the earth's crust is not homogeneous and isotropic, that the seismic focus may be of any form and magnitude, and may even consist of detached portions; that the disturbances of different points of the seismic focus are not necessarily of equal intensity, and that the disturbances do not necessarily take place simultaneously throughout the whole extent of the seismic focus. ——At recent meetings of the Geological Society of London, J. W. Hulke, the president, described the pubis and ischium of *Ornithopsis eucamerotus*, a dinosaur allied to *Ceteosaurus*, *Cama-*

rasaurus and *Atlantosaurus;* H. G. Seeley noticed *Neusticosaurus pusillus* (*Simosaurus pusillus* Fraas) showing that the structure of its palate is generically different from that of any other plesiosaur; A. W. Waters gave a list of sixty-six chilostomatous Bryozoa from Mount Gambier, South Australia, including twenty-eight species now living, and fifteen not before described; G. W. Shrubsole described a new *Phylloporus* from the Permian limestones; and Professor J. D. Dana made a communication upon the geologic age of the Taconic rocks, maintaining their Silurian age.

MINERALOGY.[1]

THE MANUFACTURE OF ARTIFICIAL DIAMONDS.—Since the now famous experiment of Mr. Hannay in the manufacture of artificial diamonds, the subject has attracted great attention, and has led to a number of experiments in the same direction.

Dr. R. S. Marsden has recently succeeded in producing minute diamonds by a simple process depending upon the solubility of carbon in fused metals, and its subsequent crystallization upon cooling.

In a graphite crucible, lined within with a paste of gum and charcoal, layers of powdered charcoal (prepared by calcining sugar) are laid alternately with small lumps of pure silver, care being taken to keep the silver always surrounded by the charcoal. The closed crucible is then heated for ten hours at the temperature of melted steel, and then buried in hot sand so as to cool very gradually.

On opening the crucible the silver is found in a single lump near the bottom, and shows a crystalline structure. The lump is now dissolved in nitric acid, when the dissolved carbon remains as a grayish-black powder of a bright graphitic luster.

When examined under the microscope, this powder is seen to consist of three different substances: (1) graphite, forming the larger proportion; (2) an amorphous brown substance in flocks, being either amorphous carbon or a carbide of silver; (3) a number of small black octahedral crystals with curved edges. These last are unattacked by hydrofluoric acid or by any acids or alkalies, are hard enough to scratch quartz, and burn in a stream of oxygen gas. These, therefore, appear to be true diamonds, and it is probably merely a matter of experiment whether they can be produced of sufficient size to be of value.

PYRITES AS A SOURCE OF SULPHURIC ACID.—The use of pyrites as a source of sulphuric acid has long been known, but it is only within a few months that American pyrites has been used for that purpose. The distance of deposits of pyrites in this country from manufacturing centers has been the chief drawback. Two

[1] Edited by Professor H. CARVILL LEWIS, Academy of Natural Sciences, Philadelphia, to whom communications, papers for review, etc., should be sent.

mines of pyrites have lately been devoted to the manufacture of sulphuric acid. These are the Capelton mines of Canada and the Milan mines of New Hampshire. After the ore has been burned to drive off the sulphur, the cinders are returned to be treated for copper, the pyrites being cupreous. It is said that a pyrites ore, in order to be useful for the manufacture of sulphuric acid, must have a high percentage of sulphur, be near a market, be of medium coarseness, and not be too soft; it must not fuse easily, must contain no arsenic or antimony, must not decrepitate when heated, and must burn readily and down to a low percentage of sulphur: otherwise it will not pay.

A DIMORPHOUS FORM OF TIN.—Small crystals of tin are sometimes found in the slag from the smelting furnaces of tin works. As shown by Trechmann, in slag from Penzance, and by Foullon in slag from Mariaschein, the tin crystals may be of two kinds, either the ordinary tetragonal form, such as are deposited by galvanic action, or, more generally, an *orthorhombic* form, not previously observed.

The general appearance of the latter is that of a loose, irregular mass of thin plates of different sizes, sometimes a quarter of an inch square, which have a bright metallic luster and a grayish color. These plates are built up of a number of sub-crystals, which, having well defined edges, were capable of goniometrical measurement. They were found to have the axial ratio: $a : b : c = 0.387 : 1 : 1.035$.

BLASTING WITH LIME.—A new and ingenious method of blasting has lately been tried at a coal mine in Derbyshire, which, dispensing with the use of gunpowder, depends upon the action of water upon caustic lime. Cylindrical blocks of caustic lime, 2½ inches in diameter by 4½ in length, are prepared by the compression of burnt lime under a hydraulic press. The blocks, each of which has a longitudinal groove ½ inch in diameter, are taken in air-tight boxes to the mine and placed in holes some three feet deep, which have been bored in the coal. By means of an iron pipe which fits into the grooves in the blocks, water is now introduced to the bottom of each hole.

In the course of a few moments a sound like that of steam escaping under high pressure, is heard, which is immediately followed by the breaking down of the coal. There is no sudden explosion or danger from fire.

This method is of course inapplicable for the blasting of hard and compact rocks.

THE FORMATION OF SULPHUR IN THE SOIL OF PARIS.—In the course of an excavation for a sewer in the streets of Paris, the workmen encountered a mass of rubbish consisting of animal and vegetable refuse mixed with bones and with plaster. The bones were filled with crystalline acicular gypsum, and the plaster was

impregnated with crystals of native sulphur. As shown by Daubrée, there is no doubt but that a chemical action has taken place between the organic matter and the plaster to produce these crystals of sulphur. A similar reaction may explain the formation of sulphur in stratified rocks.

MINERALOGICAL NOTES.—The amethysts of the Saxon Obergebirge are found frequently to have become soft and friable. They are often reduced to a fine powder, in which state they are known as *mealy quartz.*——An asbestos from Silesia, made up of short bundles of white interwoven fibers, has been found to contain more than three per cent. of soda.——*Gilbertite*, a mineral from the Saxo-Bohemian tin veins is, according to Frenzel, not a distinct species, but a transition product of the alteration of topaz into potash-mica. The topaz becoming white or greenish-gray, is then called gilbertite, while the latter afterwards becoming laminated and paler in color, finally becomes a potash-mica. Such changes of mineral species are of great interest. ——E. F. Smith and N. W. Thomas announce new localities for *corundum* and *wavellite* in Lehigh county, Penna. The former occurs in well defined and often large hexagonal crystals near Shimersville. One crystal was eight inches long and four and a-half inches wide. The locality has been leased for technical purposes. Wavellite was found in white, radiating nodules upon limonite, near Macunzie, in the same county. It has the composition Al_2O_3 36.66, P_2O_5 34.14, H_2O 28.32, Fl. *trace*, limonite 0.60 = 99.72.—— At a recent meeting of the Microscopical Society of Belgium, M. Prinz read a paper upon the microscopic inclusions in sapphire, ruby and spinel. The paper is accompanied by a plate giving drawings of the remarkable liquid and solid enclosures, the crystals and the microlites which occur in these gems. The minute, hair-like crystals which produce the beautiful asterism of some rubies, are probably rutile.——*Cerite* has recently been shown to contain a new element, to which the provisional name of Beta-Didymium has been given. Ordinary didymium is supposed to be a mixture of at least three different elements, one being true didymium, another being a more basic element of lower atomic weight (Di–β) and the third a less basic element with higher atomic weight.

GEOGRAPHY AND TRAVELS.[1]

AFRICAN EXPLORATION.—Dr. Stecker has left Abyssinia for Kaffa in company with an embassy which has recently visited Abyssinia to offer the allegiance of the Sultan of Kaffa to King Johannes. He, therefore, has good reason to hope for a favorable reception in that country.

Some of the results of the six years' exploration of Shoa and

[1] Edited by ELLIS H. YARNALL, Philadelphia.

Southern Abyssinia by the Italians, are mentioned in a recent address by Captain Cecchi before the Italian Geographical Society. The position of twenty places has been determined by careful astronomical observations and the correctness of D'Abaddie's work in Enarea and Kaffa has been established. The furthest point reached by Cecchi and Chiarini are the River Maira in lat. 7° 40′ N., long. 39° 30′ E., undoubtedly one of the head streams of Haines River, and the kingdom of Kullo to the south of Kaffa which Cecchi traversed as far as lat. 6° 30′ N.

Another Italian, Captain Casati, has succeeded in visiting a few villages of Akka to the south of Tangasi, the present capital of Monhutter.

The *Academy*, in speaking of the report of Herr Marno of his survey of the Lower Bahr el Ghazal as far as the mouth of the Bahr el Arab in lat. 9° 5′ N., observes that as a matter of course it differs very essentially from all preceding surveys, so-called. In fact, no satisfactory map of a river of the nature of that in question can be produced, unless the surveyor is in a position to determine the location of a number of points by careful astronomical observations. At present, and notwithstanding the extensive labors of Petherick, Schweinfurth, Dr. Junker and others, not a single longitude has been satisfactorily determined in the vast region lying to the westward of the Upper Nile, while the latitudes are few and far between.

The latest news from the missionaries at Rubaga, Uganda, is very satisfactory. The weakening of the aggressive power of Egypt on the north has done much to restore quiet to the country.

A number of the natives engaged on the construction of the road from Lake Nyassa to Lake Tanganyika have been killed and the work was temporarily suspended, but it was hoped that operations would be resumed in May.

Dr. Pogge and Lieutenant Wissmann on the 11th of August, 1881, were in Mieketta, eight marches north-north-east from Kimbundo. They were proceeding northward and aiming to reach Mukenge's town in the country of the Tuschilange in about lat. 5° S. This is said to be about a thirty-six days' journey along the left bank of the Chikapa River to its junction with the Kassi, and thence down that stream to near the mouth of the Lulua. The Tuschilange are said to be great traders, and Dr. Pogge hopes to meet with no opposition in exploring their country and visiting Lake Mukambo, which is reputed to be about five days journey to the east. This body of water is described as about forty miles in circumference.

Dr. Buchner, in a paper read before the Bremen Geographical Society, describes the territory of the Muata Yanvo as consisting in the main of wide upland savannas, intersected by valleys, portions of which are densely wooded. The fauna is remarkably

poor. Neither lions nor elephants were seen by the explorer, and even antelopes were scarce, and never found in herds as in the south. The Muata Yanvo is avaricious, like all these African kings, but he is not cruel. Only three executions took place during Dr. Buchner's six months' residence, and these for criminal offences. At the residence of King Tambu, at Kabong, Dr. Buchner met with a very superior description of native weapons and woven fabrics, a fact which he thinks points to the existence of highly civilized tribes in the interior which have not hitherto come into contact with Europeans.—*Athenæum.*

The Royal Geographical Society's *Proceedings* states that the members of the Livingstone Inland Mission succeeded in reaching Stanley Pool in December last. They traveled on the south side of the Congo from Banza Manteka to a point opposite Bemba, and passed through forty miles of country not previously traversed by Europeans. They found it densely populated, villages or "towns" being passed every few miles.

The people were comparatively fearless and friendly, and food was fairly abundant, large gardens in a good state of cultivation surrounding most of the towns; the tracks of elephants and buffalos were continually seen during the journey, and sometimes the animals themselves at uncomfortably close quarters. At Bemba the party crossed to the north bank of the Congo and finished the journey to Stanley Pool on that side, reconnoitering the country with a view to the selection of suitable sites for future stations. They walked 169 miles in all, thirty-one of which were along Mr. Stanley's road, now nearly overgrown with grass. Bwa-Bwa-Njali and the other chiefs were at first friendly, but suddenly turned hostile and refused to let them cross to the south bank in order to carry out their plan of returning by that way. This action the missionaries seem to attribute to the operation of M. de Brazza's treaty, and they consequently retired to the Nkemke River, near which they secured land for a station from the chief of a populous district. Before proceeding with building operations, they went on to Bemba, and letters they there found waiting for them determined them first of all to explore the whole of the south bank from Bemba to Stanley Pool, in order to see which would be the best way to take up the steamer for the upper river. On this second journey of exploration the party started about the middle of January. On April 26th, reinforcements left Liverpool for the Congo, including a physician and a practical astronomer.

Dr. Danckelmann, a competent meteorologist, is about to join Mr. Stanley on the Congo.

Petermann's Mittheilungen publishes a recomputation of Stanley's hypsometrical observations, by Dr. Zöppritz, who assigns the Victoria Nyanza an altitude of 4058 feet.

Herr Flegel has started from Loko on the Benue for Adamawa.

Captain Burton and Commander Cameron have returned from the Gold Coast to England with large and valuable collections in all branches of natural history. Com. Cameron has also made extensive surveys.

Dr. Gumbel, director of the Bavarian Geological Survey, after an examination of specimens of ore from the Gold Coast, doubts whether there exists any country in the world which holds out so fair a hope of a continuous supply of gold as do the inland districts of the Gold Coast.

A correspondent of the London *Daily News* writes that the Italian travelers, Captain Bianchi and Signor Licata, are about to undertake an extensive journey in Africa. From the Bay of Biafra, in Guinea, they will traverse the hitherto unexplored high levels of the Cameroon Mountains in the direction of the Labi Lakes, and study the country in which rise the Congo, Niger, Gazelle Rivers, and Lake Tsad, to find the key of the hydrographic system of tropical Africa. From the lakes they will descend to Lake Luta, which was partly explored by Signor Gessi. They will then traverse the Uganda territory, going north-east towards the Gallas country, already known to Capt. Bianchi, and return to Italy *via* Abyssinia and the Red Sea, having thus crossed Africa from west to east. They believe it will take four years to complete this immense journey, which will have principally a scientific aim.

THE CIRCUMPOLAR STATIONS. — The steamer *Pola*, Captain Müller, left Pola on April 2d last with the staff and equipment of the Austrian Meteorological Expedition, consisting of fourteen persons. She expected to arrive at Jan Mayen early in May, and after leaving the party, with all the stores, will return home. The Austrians are to remain until August, 1883. Stores are supplied for two years, and three boats are provided for the escape of the expedition should the relief vessel not reach Jan Mayen next summer.

The German Committee held a meeting at Berlin on April 13th, and they are reported to have decided to erect one observing station in the northern arctic zone at Cumberland Sound, Davis Strait, and a second on one of the islands of South Georgia, 54° 30′ S. lat., 41° 30′ 15″ W. long., and some 1100 miles east of Cape Horn. The former expedition will be commanded by Dr. Giese and the latter by Dr. Schrader, of the Hamburg Observatory, and each will consist, besides, of six additional observers and three or four workmen. Both parties will leave Europe early in June. Dr. Schrader proceeding by mail steamer to Monte Video, and thence by a German man-of-war to their destination, but no definite arrangements have yet been made for the conveyance of Dr. Giese's expedition to Cumberland Sound.

The Swedes expect to open a station on Spitzbergen during the summer. It will probably be established at Mussel Bay, on

the east side of Wyde Bay on the northern coast of West Spitzbergen, where Nordenskiöld and Palander wintered in 1872–3, and the expedition expects to use the building then erected on Polhem Island. There will be thirteen in the party.

The British have finally selected Fort Rae for their station.

MICROSCOPY.[1]

MICROSCOPIC DEXTERITY OF THE CAMEO CUTTERS.—One of the best examples of adroit manipulation under the simple microscope is the operation of cameo cutting as described in an article in *Our Home and Science Gossip*:

"A visit to a cameo cutter's workshop found him seated at a table covered with tools, varying from a triangular-pointed steel instrument to the most delicate pointed bits of steel wire fastened in handles. Very fine files and knitting needles, set in wooden grips and ground to infinitesimal points, figured in the lot. On a pad of leather, before the cameo cutter, was a block of wood just big enough to be grasped with his hand, and cemented to the middle of it was an oval object that looked like a piece of alabaster, just big enough to make a seal for the finger of a man who did not object to wearing large rings. Upon this the artist was just finishing a copy, with a pencil pointed to needle fineness, of a photograph in profile of a gentleman, which was leaned against a little photograph easel before him. Having finished the outline, he laid his pencil by, and taking up a fine wire tool he scratched the pencil mark around with it. Then he took a darning needle with a sharp point and scratched the line deeper. He worked with a magnifying glass at his eye, and stopped continually to inspect the progress of his work with critical minuteness. Then he went at it again, working slowly, scratching over the same line again and again, and always examining after each scratch. He changed his tools as he went on, and from the darning needle descended to a trifling little fragment of steel wire, not as thick as an ordinary sewing needle, set in a slender handle. With this he scratched and re-scratched, until the lines he had drawn with his pencil had quite vanished, and a thin, fine streak of a dark color had marked the outline of the head he had been tracing his way around. Next he took one of his burin-like tools and commenced again. This time he worked on the outside of the outline, cutting and scraping at the surface until the white turned gray, then brown, and finally vanished, leaving the face in relief, surrounded by a black ground—that is, the portrait remained intact in the white substance which formed the outer layer of the cameo, while it had been cut away around it to the lower or dark layer. The portrait or figure is then modulated upon its surface until it assumes the roundness of nature. The edges are left square to the dark ground. This is necessary, as, if they are

[1] This department is edited by Dr. R. H. WARD, Troy, N. Y.

gradually rounded down, the outline becomes undefined toward its juncture with the relieving surface, owing to the white of the raised portion being partially transparent and permitting the dark to show through it when it is thinned down. Care is taken to finish this dark surface as much as possible with the cutting tools, and so separate the white from it as to leave it smooth and unscratched. A final polish is given it, however, with putty powder applied dry with a stiff brush, but the utmost care is necessary in this operation, as the slightest slip will ruin the work. This is the cameo cutter's work, the mountings being the jeweler's work. The cameos sell, unmounted, for about $25."

THE MICROSCOPE IN THE DETECTION OF FORGERY.—The Boston *Journal of Chemistry* for August, publishes some "interesting paragraphs" from a recent lecture in England, by Mr. Jno. Rogers. The quotations are an abstract, though not so credited, of remarks in Dr. R. H. Ward's lecture on the Practical Uses of the Microscope, delivered as president's address at the Buffalo meeting of the American Society of Microscopists, in August, 1879. Not only is the substance taken from that source, but numerous phrases and entire sentences are copied word for word. Dr. Ward's publication upon the subject was based upon more than twenty years of original work in a field then new and practically unoccupied, and, in appropriating his work, credit should have been given so fully and conspicuously, that it could not be overlooked or misunderstood.

KENT'S INFUSORIA.—The sixth part of Mr. W. Saville Kent's Manual of the Infusoria, just issued by David Bogue, of London, completes a work that will be a classic in microscopy. The book is the more remarkable as showing how much of excellent work can be accomplished in a limited time, the author having explained that when he undertook this study, ten years ago, he was but a beginner in practical microscopy. Finding the literature of his chosen subject to be fragmentary and scattered, and practically unavailable, he undertook to compile a manual that should bring to the knowledge of English-speaking microscopists the vast number of species of Infusoria now known to science. It soon became evident that the original plan of covering the broad field occupied by Ehrenberg and Pritchard, was far too comprehensive for the present state of knowledge. A more limited group was therefore adopted, represented by the flagellate, ciliate and tentaculiferous Protozoa; and these have been elaborated with great thoroughness, much original research being incorporated along with the record of previously described forms. Questions of affinity and derivation, of interest in general biology, have been well kept in view; and an additional plate with description of the apparatus specially adapted to the study of infusorial life, will be appreciated even by experienced students. The work comprises three

large octavo volumes; it is lavishly illustrated, and derives additional value from an extensive glossary, bibliography and index.

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SCIENTIFIC NEWS.

— Professor H. W. Parker, of the Iowa College, Grinnell, Ia., has issued a circular which we are sure will appeal to the generosity of every naturalist and museum in the country, who, we hope, will send duplicates to restore the ill-fated collections of that college. It will be remembered that by the tornado of June 17th, the college buildings were demolished and with them the museum. Professor Parker, the curator, is now in the East collecting specimens and money to restore the collections, and it is hoped that there will be a generous response. The department has earned a claim to help. Without a fund, and mostly by the labors of the curator, the college had accumulated one of the best collections in the West.

— A committee, of which Professor Asa Gray is chairman and Alexander Agassiz is treasurer, has been requested by the English executive committee of the Darwin Memorial to join them in obtaining subscriptions from those in America who may wish to join in this tribute to the memory of Darwin. The form which the memorial is to take has not yet been decided; it will probably include an endowment for a scholarship to carry on biological research.

Subscriptions may be sent to Alexander Agassiz, Cambridge, Mass., who will acknowledge the same and forward them to the treasurer of the English executive committee of the Darwin Memorial.

— Mr. S. A. Forbes, of Normal, Ill., the founder of the Illinois State Laboratory of Natural History, and who has added so much to our knowledge of the food and habits of our birds and fishes, has been appointed State Entomologist in place of Professor Cyrus Thomas, resigned. The appointment is a most fitting one.

— The number of fellows of the Zoölogical Society, of London, is 3213. The total receipts for 1881 amounted to £25,810, while the number of visitors in 1881 were 648,604, and the number of animals were 2294.

— The Hon. George P. Marsh, well known to many of our readers as the author of "Man and Nature," and of a government report on the camel, died in Italy, July 24th. He was born in Vermont in 1801.

— Gen. G. K. Warren, U. S. A. Engineer Corps, who died at Newport, Aug. 8th, was not only a distinguished general, but, in connection with his work published several valuable memoirs on the physical geography of the United States, particularly of the Upper Mississippi. He also commanded several important Government exploring expeditions. He was a member of the National Academy of Sciences.